ZooKeys 1184: 327–359 (2023)
DOI: 10.3897/zookeys.1184.109476

Research Article

A taxonomic study of *Psyllaephagus* Ashmead (Hymenoptera, Encyrtidae) from China

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Abstract

Fifteen species of *Psyllaephagus* from China are studied. Three species, *P. clavus* Zou & Zhang, **sp. nov.**, *P. obliquus* Zou & Zhang, **sp. nov.**, and *P. tangae* Zou & Zhang, **sp. nov.**, are described as new to science. A diagnosis or a description/redescription, figures of the characters, as well as the known distribution and hosts of each species are provided. A dichotomous key is also given to facilitate the identification of species.

Key words: Aphalaridae, Carsidaridae, Homotomidae, Psyllidae, Triozidae

OPEN ACCESS

Academic editor: Kees van Achterberg
Received: 14 July 2023
Accepted: 1 October 2023
Published: 23 November 2023

ZooBank: https://zoobank.org/3FFAF34C-1BC1-4DA7-A4C3-DFDC1A4DE08B

Citation: Zou B, Hu H, Zhang L, Zhang Y (2023) A taxonomic study of *Psyllaephagus* Ashmead (Hymenoptera, Encyrtidae) from China. ZooKeys 1184: 327–359. https://doi.org/10.3897/zookeys.1184.109476

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Introduction

In the family Encyrtidae, *Psyllaephagus* Ashmead, 1900 is one of the largest genera with approximately 246 recognized species (Noyes 2019). Most species of *Psyllaephagus* are primary parasitoids of psylloids (Hemiptera: Psylloidea), whilst some are secondary (Noyes and Hanson 1996; Trjapitzin 2012). Among *Psyllaephagus*, three species from Australia have been successfully used for biological control of psylloids. *Psyllaephagus pilosus* Noyes, 1988 from Australia was introduced and released in California and European countries to control *Ctenarytaina eucalypti* Maskell, 1890 (Dahlsten et al. 1998; Hodkinson 1999; Chauzat et al. 2002). *Psyllaephagus bliteus* Riek, 1962 was introduced and released in California to control *Glycaspis brimblecombei* Moore, 1964 (Daane et al. 2005). *Psyllaephagus yaseeni* Noyes, 1990 was introduced into Hawaii and south-east Asia for control of *Heteropsylla cubana* Crawford, 1914 (Beardsley and Uchida 1990).

The greatest number of species occur in Australia where 100 species of *Psyllaephagus* have been described, although there may be as many as 1,000 species (Noyes and Hayat 1984). Species of *Psyllaephagus* in the Costa Rican region were studied by Noyes and Hanson (1996). Girault (1915) and Riek (1962) reported a number of species from Australia. Trjapitzin (1989) revised *Psyllaephagus* and provided a key to 57 species distributed in Palaearctic region. Twenty species of *Psyllaephagus* are recorded from India (Singh 1996; Hayat 2003), and 22 species from Africa (Prinsloo 1981). The Chinese fauna have been studied by Tan and Zhao (1999), Xu et al. (2000a, b), Tang et al. (2016), and Wu et al. (2021). Several species names used in a Master's thesis by Li (2010) and a PhD thesis by Zhang (2001) are unavailable because these theses have not been formally published.

The present paper is intended as a comprehensive taxonomic study of all known species from China. However, we were not able to examine the specimens of *Psyllaephagus belanensis* (Hoffer, 1963) mentioned by Ma (2004) and *P. belanensis* is therefore not included in this study.

Materials and methods

Many of the specimens included the present study were reared from psylloids collected from different regions of China. Twigs and/or leaves with psylloids were collected and brought back to the Key Laboratory of Zoological Systematics and Evolution (Institute of Zoology, Chinese Academy of Sciences, **IZCAS**) and college of Life Science and Technology, Xinjiang University (**ICXU**). Twigs and/or leaves with psylloids nymphs were kept in nylon bags (100 mesh) for at least one month to allow parasitoids to emerge. Parasitoids were collected and preserved in ethanol (99%). The remaining specimens were collected by using a sweeping net (see Noyes 1982). Part of the newly collected specimens were card-mounted, and others had been dissected and mounted on slides generally following the method described by Noyes (1982). Observation and measurement of specimens were made with a Nikon SMZ-168 stereomicroscope. Microphotographs were taken with a Canon EOS550D digital camera connected to a Leica DM-2500 microscope, and photographs of card mounted specimens were produced using a Nikon D7000 digital camera coupled to a Nikon SMZ-1500 stereomicroscope. All materials examined are deposited in IZCAS and ICXU.

Morphological terminology and abbreviations follow that of Noyes and Hanson (1996) and Gibson (1997) with some modifications. Absolute measurements were used for body length. Abbreviations used in the text are as follows: **HW**, maximum head width; **HL**, minimum head length; **FV**, the width of the frontovertex; **OOL**, the minimum distance between the eye margin and the nearest posterior ocellus; **POL**, the minimum distance between the posterior ocelli; **SL**, the length of the scape; **SW**, maximum width of the scape; **F1** through **F6**, 1st to 6th funicular segments; **MSL**, mesoscutum length; **MSW**, mesoscutum width; **MT**, mid tibia length; **MV**, marginal vein length; **PMV**, postmarginal vein length; **STV**, stigmal vein length; **FVL**, the maximum length of fore wing; **FVW**, the maximum width of fore wing; **OL**, length of ovipositor; **GL**, length of third valvula.

Abbreviations of depositories: **IZCAS**, Institute of Zoology, Chinese Academy of Sciences, Beijing, China; **CNEP**, Collection of Natural Enemies of Pests, Hubei University, Hubei, China; **ICXU**, Collection of Life Science and Technology, Xinjiang University, Xinjiang, China; **TARI**, Insect Museum, Taiwan Agricultural Research Institute, Taiwan, China; **ZUIE**, Institute of Applied Entomology, Zhejiang University, Zhejiang, China; **TJAU**, Insect Collection of Tianjin Agricultural University, Tianjin, China; **ZISP**, Zoological Institute, St Petersburg, Russia.

Results

Genus *Psyllaephagus* Ashmead, 1900

Psyllaephagus Ashmead, 1900: 382. Type species: *Encyrtus pachypsyllae* Howard, 1885 by original designation. Type locality U.S.A.

Mirocerus Ashmead, 1904: 309. Type species: *Mirocerus peyelae* Ashmead, by original designation. Type locality Sri Lanka. Synonymized with *Psyllaephagus* by Trjapitzin (1978: 636).

Calocerineloides Girault, 1913: 11. Type species: *Calocerineloides ramosa* Girault, by original designation. Type locality Australia. Synonymized with *Psyllaephagus* by Noyes and Hayat (1984: 330).

Epanagyrus Girault, 1915: 160. Type species: *Epanagyrus punctatiscutum* Girault, by original designation. Type locality Australia. Synonymized with *Psyllaephagus* by Noyes and Hayat (1984: 330).

Neanagyrus Girault, 1915: 174. Type species: *Neanagyrus capitatus* Girault, by original designation. Type locality Australia. Synonymized with *Psyllaephagus* by Dahms and Gordh (1997: 305).

Anagyropsis Girault, 1917: 136. Type species: *Anagyropsis purpureus* Girault, by original designation. Type locality Australia. Synonymized with *Psyllaephagus* by Noyes and Hayat (1984: 330).

Metaprionomitus Mercet, 1921: 260. Type species: *Metaprionomitus intermedius* Mercet, by original designation. Type locality Spain. Synonymized with *Psyllaephagus* by Trjapitzin (1967: 192).

Shakespearia Girault, 1928: 3. Type species: *Shakespearia flabellata* Girault, by monotypy. Type locality Australia. Synonymized with *Psyllaephagus* by Noyes and Hayat (1984: 330).

Psyllencyrtus Tachikawa, 1955: 63. Type species: *Psyllencyrtus syntomozae* Tachikawa, by original designation. Type locality Japan. Synonymized with *Psyllaephagus* by Tachikawa (1981: 88).

Calluniphilus Erdös, 1961: 413. Type species: *Calluniphilus vendicus* Erdös, by monotypy. Type locality Australia. Synonymized with *Psyllaephagus* by Graham (1969: 248–249).

Ooencyrtoides Hoffer, 1963: 235. Type species: *Ooencyrtoides albopilosus* Hoffer, by original designation. Type locality Czech. Synonymized with *Psyllaephagus* by Graham (1969: 248–249).

Propsyllaephagus Blanchard in De Santis, 1964: 235. Type species: *Propsyllaephagus trellesi* Blanchard, by monotypy. Type locality Argentina. Synonymized with *Psyllaephagus* by Noyes (1979: 165).

Mercetia Bakkendorf, 1965: 139. Type species: *Copidosoma lusitanicum* Mercet, 1921 by original designation. Type locality Spain. Synonymized with *Psyllaephagus* by Graham (1969: 248–249).

Kaszabicyrtus Szelényi, 1971: 389. Type species: *Kaszabicyrtus acutigastris* Szelényi, by original designation. Type locality Mongolia. Synonymized with *Psyllaephagus* by Trjapitzin and Gordh (1978: 636).

Other citations. Trjapitzin 1978, 1989; Noyes and Hanson 1996; Myartseva 1980, 1984; Zhang and Huang 2004; Japoshvili et al. 2016.

Diagnosis. Female. Body length 0.8–3.0 mm usually dark brown with green or blue sheen and with metallic luster; occiput margin often rounded, rarely carinate; mandible with one tooth and a truncation (Fig. 1B), or with two teeth and a truncation (Fig. 2B), rarely with three teeth; funicle 6-segmented; clava often 3-segmented or entire, rarely 2-segmented; fore wing fully developed, often hyaline, rarely with a smoky spot under marginal vein and stigmal vein; marginal vein usually punctiform or slightly longer than wide (Fig. 15C), rarely 2–3× as

long as broad; postmarginal vein usually shorter than stigmal vein, occasionally absent, in some species as long as or even longer than stigmal vein; mesopleuron in side view clearly separated from base of metasoma by propodeum; mid tibia spur usually shorter than basal tarsus; hypopygium very rarely reaching apex of metasoma; ovipositor hidden, slightly to strongly exserted. Male essentially similar in appearance except for antennae and genitalia: the funicle varying from whiplike with long setae to flattened with short setae, clava entirely; the genitalia usually developed and exserted.

Psyllaephagus arenarius **Trjapitzin, 1967**

Fig. 1

Psyllaephagus arenarius Trjapitzin, 1967: 192. Holotype ♀, Russia (ZISP), not examined.

Psyllaephagus arenarius Trjapitzin, 1968: 96–97, 1978: 301, 1981: 14–16; 1989: 256; Zhang et al. 2017: 842–846.

Material examined. China – **Ningxia** • 13♀♀, 12♂♂, Zhongwei, 09.Jul.2016, leg. PX Wu, ex. *Bactericera gobica* on *Lycium barbarum*; Zhonwei, 17.Aug.2016, PX Wu leg., ex. *Bactericera gobica* on *Lycium barbarum*; 22♀♀, 37♂♂, 11♀♀, Jixian, 17.Apr.2017, leg. X Zhang; **Shandong** • 10♀♀, 3♂♂, Junan, 11.Jun.2018, leg. YZ Zhang.

Diagnosis. Female. Body length ~ 1.3 mm; mid and hind coxae dark brown, basal ~ 2/3 of hind femur dark brown; F1–F5 usually a little longer than wide, F6 quadrate (Fig. 1A); ovipositor not or hardly exserted (Fig. 1H), OL ~ 1.1× as long as MT.

Description. Female. ***Body*** length 1.2–1.6 mm. Frontovertex and scrobe with blue-violet sheen; mesoscutum, axillae metallic green; scutellum with a golden-green sheen; metasoma with metallic green sheen; scape and pedicel dark brown, but apex of 1/5 scape and 1/3 pedicel paler; funicle and clava yellowish brown (Fig. 1A); tegula pale yellow, except apex dark brown; legs yellow, except basal 1/4 of fore coxa brown, mid and hind coxae dark brown, basal 2/3 of hind femur dark brown (Fig. 1E–G); wings hyaline, venation brown (Fig. 1B).

Head with reticulate sculpture; HW 2.1× HL in dorsal view, and ~ 3.0× FV; ocelli form acute angle of slightly < 90°; OCL ~ 1.7× diameter of posterior ocellus; OOL ~ 1.0× diameter of posterior ocellus; POL ~ 2.7× diameter of posterior ocellus; mandible with one tooth and a broad truncation (Fig. 1C); upper margin of torulus below level of lower eye margin; antenna with scape ~ 4× as long as wide; pedicel ~ 1.9× as long as wide; F1–F5 longer than broad, F6 subquadrate; clava 3-segmented, as long as F4–F6 combined, nearly 2.2× as long as wide with apex rounded. Relative measurements: HW 22; HL 10.4; FV 7.3; OOL 2; POL 5.4; OCL 3.4; SW 2.5; SL 10.5.

Mesoscutum slightly convex; mesoscutum and scutellum with similar reticulate sculpture to that on frontovertex (Fig. 1D); pronotum ~ 0.25× as long as wide; MSW ~ 1.6× MSL; scutellum ~ 1.5× as long as wide; fore wing ~ 2.3× as long as wide; marginal vein punctiform; stigmal vein ~ 5.5× as long as wide, STV ~ 2.5× PMV; basal cell almost bare; mid tibial spur ~ 0.7× as long as basitarsus. Relative measurements: FWL 35.5; FWW 19.7.

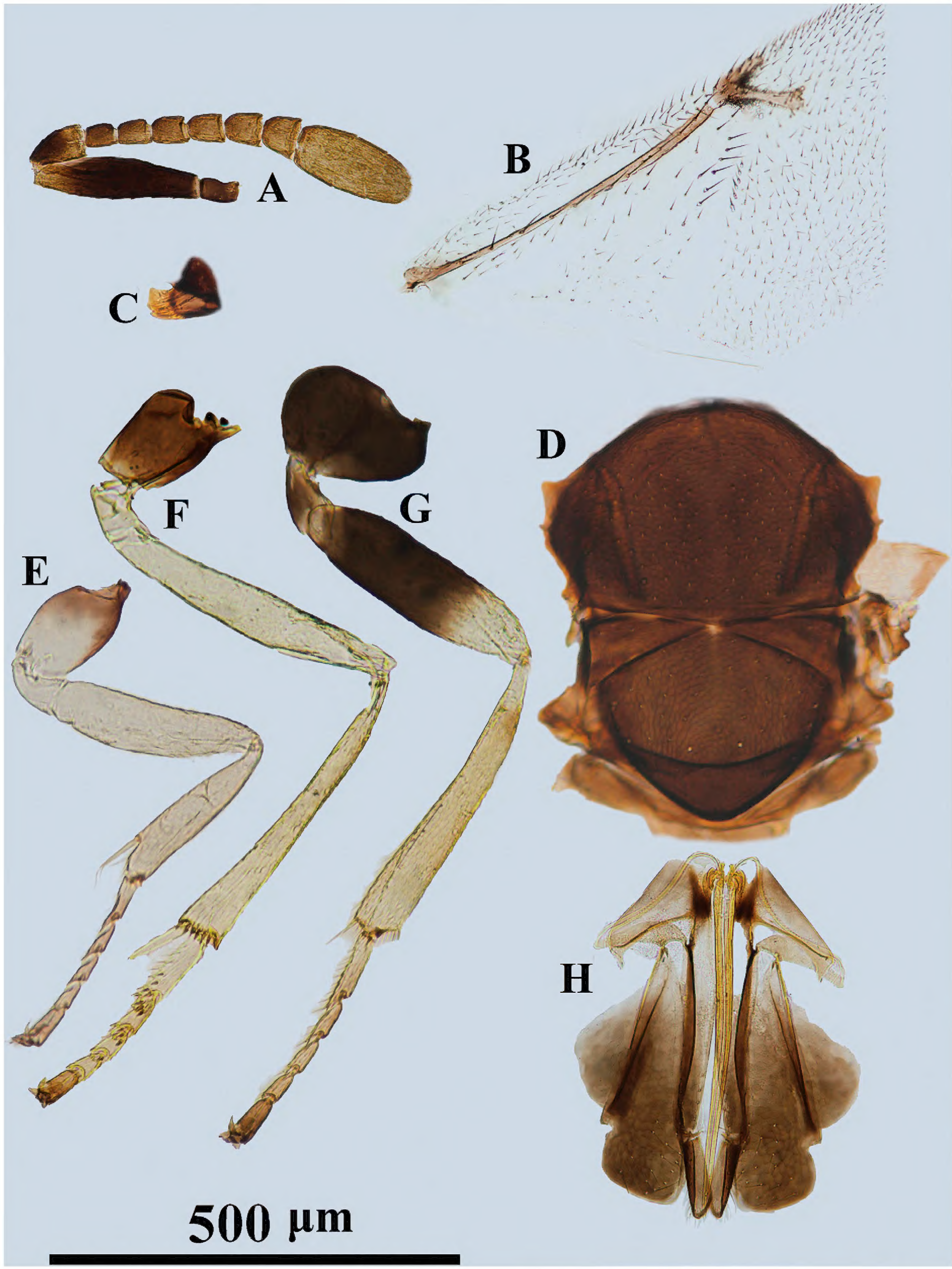


Figure 1. *Psyllaephagus arenarius* ♀ **A** antenna **B** mandible **C** fore wing **D** mesonotum **E** fore leg **F** mid leg **G** hind leg **H** ovipositor.

Metasoma ~ 0.8× as long as mesosoma; cercal plates located in the 1/2 basal of metasoma; hypopygium reaching 2/3 of metasoma; ovipositor not exserted (Fig. 1H), OL ~ 5.0× GL, and 1.1× MT.

Male. Length 1.0–1.3 mm; generally similar to female except antenna and genitalia. All funicle segments longer than broad and clothed with long setae, usually longer than funicle segments

Hosts. *Acaerus turkestanicus* Low, 1881 (Hemiptera: Psyllidae), *Bactericera gobica* Loginova, 1972 (Hemiptera: Triozidae).

Distribution. China (Ningxia, Shandong, Tianjin); other countries: Russia (Tajikistan).

Comments. The specimens studied here agree well with the original description of *P. arenarius*, except the length of clava is slightly shorter than F3–F6 combined; in the original description, the clava is approximately as long as F3–F6 combined.

Psyllaephagus caillardiae Sugonjaev, 1968

Fig. 2

Psyllaephagus caillardiae Sugonjaev, 1968: 592. Holotype ♀, Russia (ZISP), not examined.

Psyllaephagus caillardiae: Danzig and Sugonjaev 1969: 116–124; Myartseva 1984: 145, 233; Tang et al. 2016: 65.

Material examined. CHINA– **Xinjiang** • 15♀♀, 11♂♂, Shihezi, 21.Jul.2012, ex. *Caillardia azurea* on *Haloxylon persicum*, leg. HY Hu; 19♀♀, 7♂♂, Karamay, 25.Jul.2016, ex. *Caillardia notata* on *Haloxylon ammodendron*, leg. HY Hu's group; 17♀♀, 3♂♂, 18.Aug.2018, Fukang, leg. HY Hu's group.

Diagnosis. Female. Body length ~ 1.5 mm; legs yellow, but basal ~ 1/2 of mid coxae and entire hind coxae dark brown (Fig. 2E–G); ocelli forming an angle of ~ 90°; mesoscutum and scutellum with similar reticular sculpture (Fig. 2D); ovipositor distinctly exserted, the exserted part ~ 1/4 of metasoma; OL ~ 1.6× MT (Fig. 2H).

Description. See Tang et al. (2016).

Hosts. *Caillardia azurea* Loginova, 1956 and *Caillardia robusta* Loginova, 1956 (Hemiptera: Aphalaridae).

Distribution. China (Xinjiang); other countries: Kazakhstan, Mongolia, Tajikistan, Turkmenistan, Uzbekistan.

Comments. The specimens examined here agree well with the original description of *P. caillardiae*, except having the basal ~ 1/2 of mid coxa dark brown; in the original description, the mid coxae were described as yellow.

Psyllaephagus clavus Zou & Zhang, sp. nov.

https://zoobank.org/DC2C6224-5426-4FCF-8620-46CFC916A97C

Fig. 3

Psyllaeohagus nartshukae Trjapitzin: Tang et al. 2016: 72–73 (misidentification).

Type material. ***Holotype*** ♀ [on slide], CHINA –**Xinjiang**, Shihezi, 21.Aug.2012, by sweeping, leg. HY Hu group (deposited in ICXU). ***Paratypes*** 4♀♀, same data as holotype.

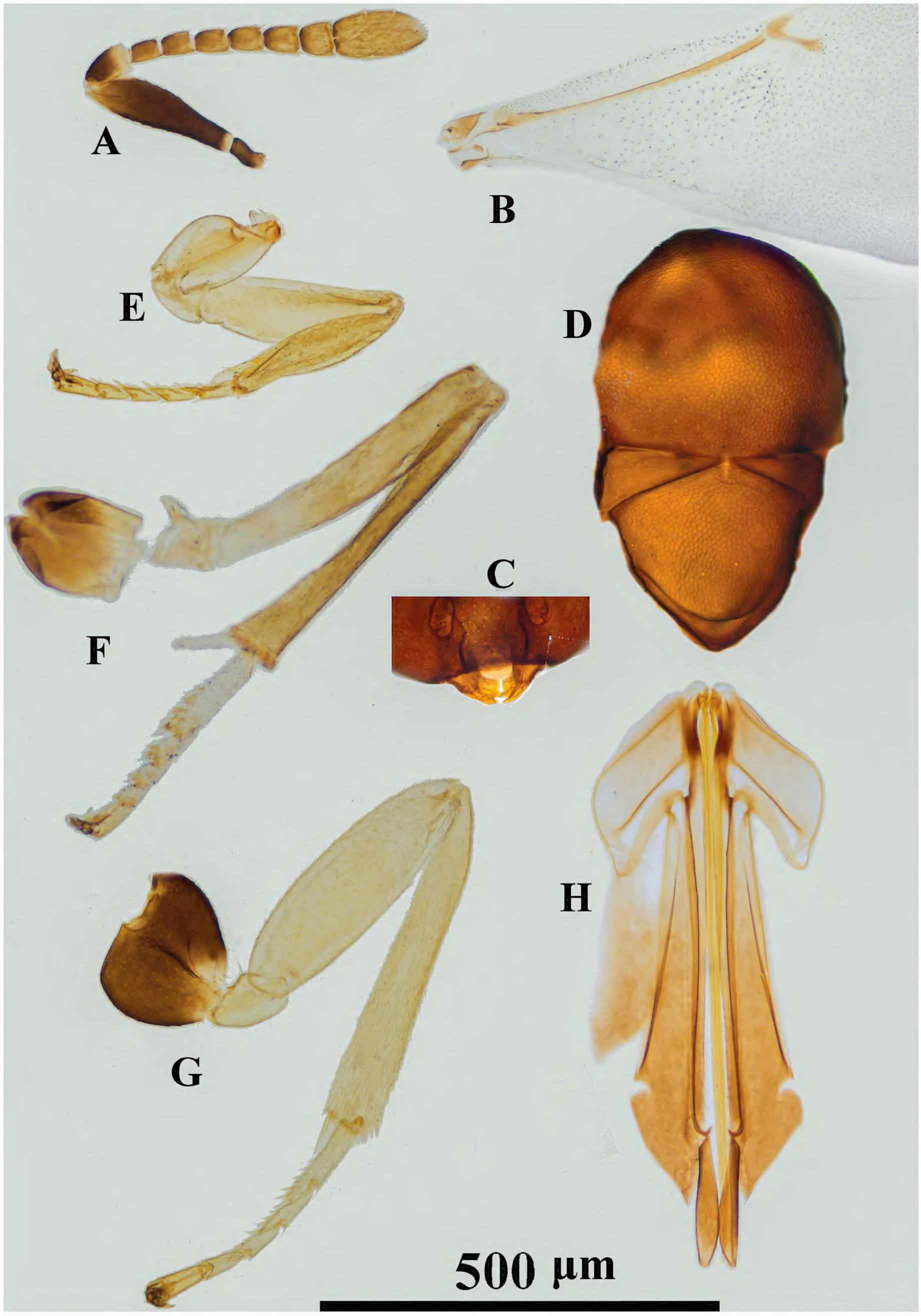


Figure 2. *Psyllaephagus caillardiae* ♀ **A** antenna **B** mandible **C** fore wing **D** mesonotum **E** fore leg **F** mid leg **G** hind leg **H** ovipositor.

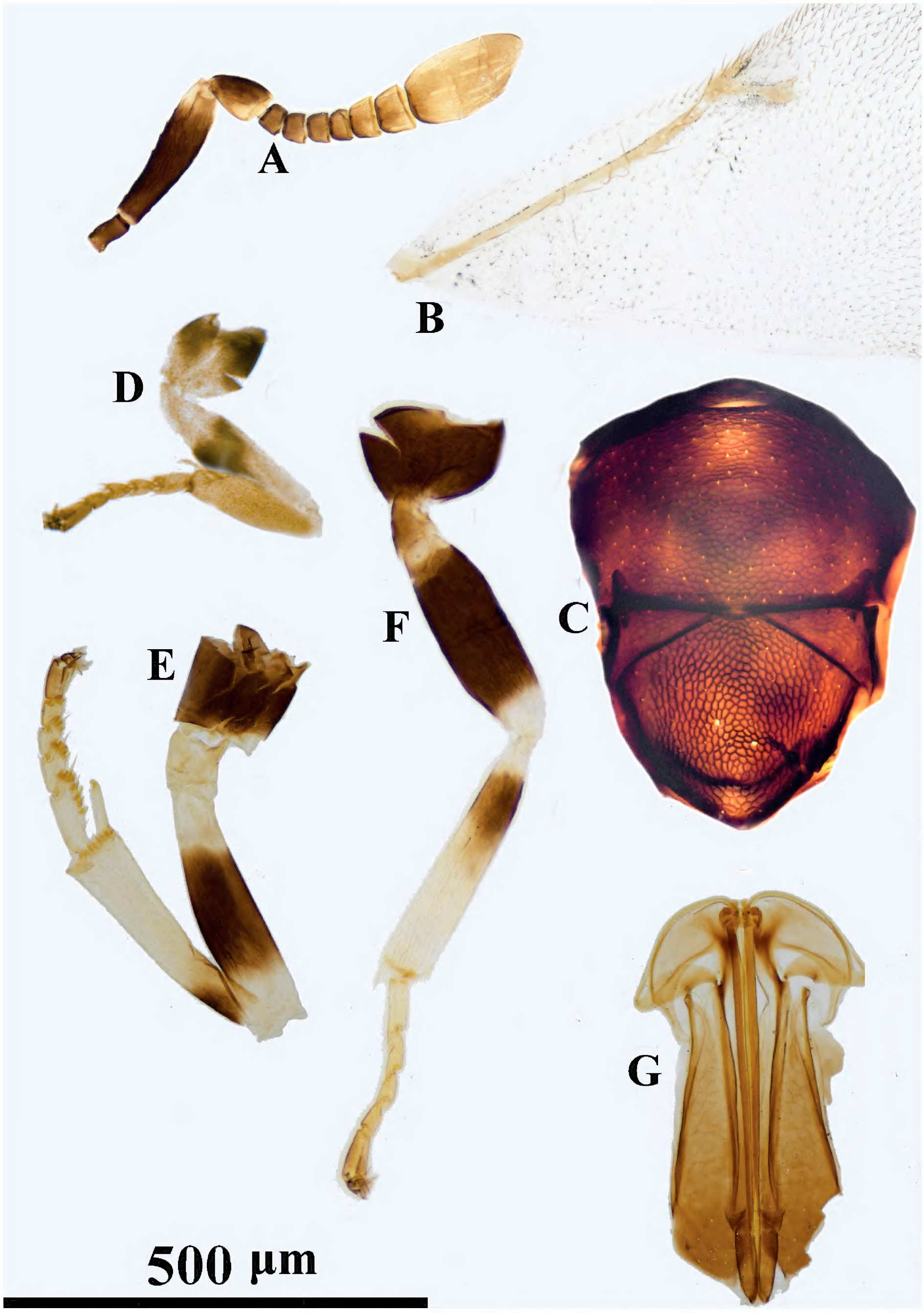


Figure 3. *Psyllaephagus clavus* sp. nov. ♀ **A** antenna **B** fore wing **C** mesonotum **D** fore leg **E** mid leg **F** hind leg **G** ovipositor.

Diagnosis. Female. Body length ~ 1.0 mm; all coxae dark brown, but apical ~ 1/3 of fore coxa yellow; femora marked with dark brown (Fig. 3D–F); all funicular segments transverse; clava longer than F3–F6 combined (Fig. 3A); sculpture on scutellum deeper than that on mesoscutum (Fig. 3C); ovipositor not exserted (Fig. 3G), OL ~ 1.5× MT.

Description. Female. ***Body*** length ~ 1.0 mm, with metallic green-blue sheen; basal 1/3 of tegula yellow, remainder dark brown; scape and pedicel except apices dark brown, F1–F4 yellowish brown, F5, F6, and clava brownish yellow; all coxae dark brown except apex of fore coxa yellow; basal ~ 1/2 of fore femur (Fig. 3D), mid femur except apices and hind femur medially dark brown; all tibiae yellow except mid and hind tibiae basally each with a dark brown spot; all tarsi yellow except apices dark brown; wings hyaline, venation brown.

Head with reticulate sculpture, HW ~ 3× FV width, and ~ 2.9× HL; ocelli forming obtuse angle of slightly more than 90°; OCL ~ 1.3× diameter of posterior ocellus; OOL ~ 0.2× diameter of posterior ocellus; POL ~ 3.9× diameter of posterior ocellus; antenna with scape 3.7× as long as wide; pedicel ~ 1.5× as long as wide; F1–F6 broader than long; clava 3-segmented, ~ 2.0× as long as wide, nearly as long as F2–F6 combined. Relative measurements: HW 16; HL 5.3; FV 7; OCL 1.7; OOL 0.3; POL 6.2; SL 6.9; SW 1.9.

***Mesosoma*.** Scutellum slightly convex; mesoscutum dorsally with reticulate sculpture similar to that on frontovertex; sculpture on scutellum similar but clearly deeper than that on mesoscutum; marginal vein ~ 2.0× as long as wide; postmarginal vein present, ~ 2.6× as long as wide; stigmal vein 4.0× as long as wide, STV ~ 2.7× PMV (Fig. 3B); mid tibia spur 0.5× as long as basitarsus. Relative measurements: FWL 33; FWW 19.5.

Metasoma obviously shorter than mesosoma; cercal plates located on the apical 2/5 of metasoma, hypopygium reaching ~ 2/3 of metasoma; ovipositor slightly exserted or hidden (Fig. 3G); OL ~ 5.6× GL, and 1.9× MT.

Male. Unknown.

Etymology. The specific name refers to its enlarged clava.

Host. Unknown.

Distribution. China (Xinjiang).

Comments. *Psyllaephagus clavus* was erroneously treated as *P. nartshukae* Trjapitzin, 1986 in Tang et al. (2016). A detailed study of the morphological characters shows that it is an undescribed species. Using the keys in Trjapitzin (1989), it runs to *P. nartshukae* Trjapitzin but can be separated from *P. nartshukae* by F1–F6 broader than long (in *P. nartshukae*, F1–F5 longer than broad); clava obviously longer than F3–F6 combined(in *P. nartshukae*, clava slightly shorter than F4–F6 combined, or as long as F4–F6 combined).

Psyllaephagus colposceniae Trjapitzin, 1969

Fig. 4

Psyllaephagus colposceniae Trjapitzin, 1969: 52. Holotype ♀, Moldova (ZISP), not examined.

Psyllaephagus colposceniae Trjapitzin, 1978: 236–328; 1989: 256; Myartseva 1979: 27–33; Tang et al. 2016: 63–78.

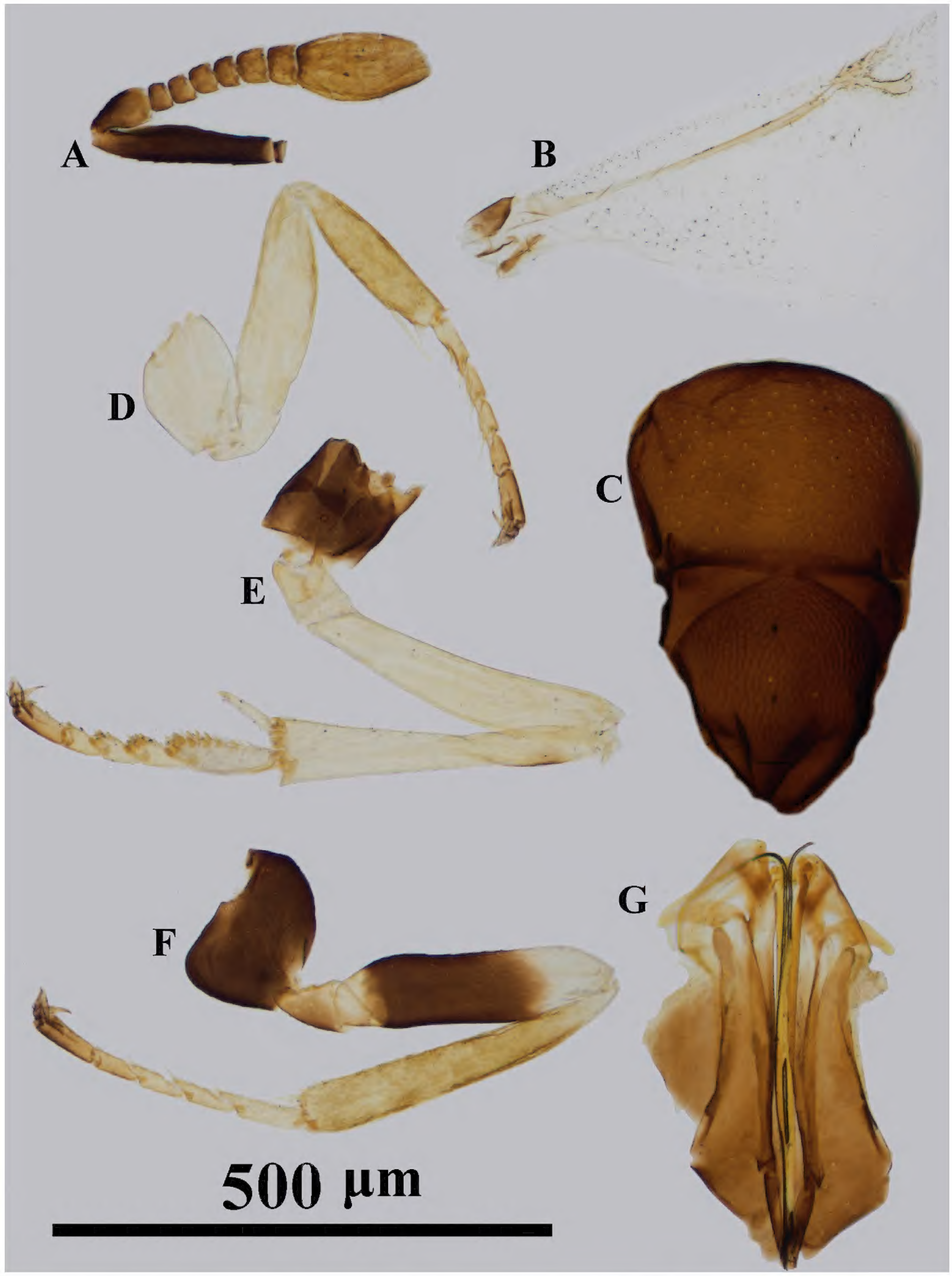


Figure 4. *Psyllaephagus colposceniae* ♀ **A** antenna **B** fore wing **C** mesonotum **D** fore leg **E** mid leg **F** hind leg **G** ovipositor.

Material examined. China – **Xinjiang** • 1♀, Karamay, 23.July.2012, by sweeping, leg. HY Hu group; 1♀, Karamay, 28.July.2014, by sweeping, leg. HY Hu group; 1♀, Hami, 1.Aug.2016, by sweeping, leg. HY Hu group; 4♀♀, 2♂♂, Altai, 11.Jun.2023, ex. *Colposcenia sp.* on *Tamarix ramosissima*, leg. BY Zou.

Diagnosis. Female. Body length ~ 1.0 mm; mid and hind coxae dark brown, mid tibia with a dark brown spot at base, basal 3/4 of hind femur dark brown (Fig. 4E, F); ocelli forming angle of slightly less than 90°; all funicular segments transverse (Fig. 4A); mesoscutum and scutellum with contrasting sculpture, sculpture on scutellum somewhat deeper than that on mesoscutum; ovipositor hidden or slightly exserted, OL ~ 1.2× MT (Fig. 4G).

Description. See Tang et al. (2016).

Host. *Colposcenia kiritshenkoi* Loginova, 1960 (Hemiptera: Aphalaridae).

Distribution. China (Xinjiang); other countries: Kazakhstan, Moldova, Turkmenistan.

Comments. The specimens studied here agree well with the original description of this species, except the slight variation in dimension of F2. In some specimens here, F2 is slightly shorter than broad (see also Myartseva 1979). We regard this difference falls within variation of a species.

Psyllaephagus densiciliatus Tan & Zhao, 1999

Fig. 5

Psyllaephagus densiciliatus Tan & Zhao, 1999: 174–175. Holotype ♀, China, Yunnan (CNEP), photos of holotype examined.

Material examined. CHINA – **Hainan** • 2♀, Nada, 1.May.1964, leg. DX Liao; 3♀♀, 1♂, Wuzhishan, 21.Jun.1999, leg. CD Zhu; **Yunnan** • 2♀♀, Mengla, 23.July.2004, leg. YZ Zhang; **Guangxi** • 3♀♀, Fangcheng, 18.July.2009, leg. YZ Zhang.

Diagnosis. Female. Body length ~ 2.2 mm; legs yellow, but mid and hind coxae dark brown (Fig. 5E, F); antenna with all funicular segments longer than broad, F6 sometimes subquadrate (Fig. 5A); ovipositor slightly exserted; OL ~ 1.2× MT.

Description. Female. ***Body*** length ~ 2.2 mm, metallic green; frontovertex and face with green-violet sheen. Antenna scape and pedicel dark brown, funicular segments brown but F6 yellow; mesoscutum with a coppery sheen; axilla and scutellum with blue sheen; basal 1/2 of tegula yellow, apex dark brown; mesopleuron metallic green mixed with golden sheen; legs yellow, but mid and hind coxae dark brown; basal 1/4 of metasoma with a metallic green sheen, remainder coppery; wings hyaline, venation brown.

Head ~ 3.0× as wide as frontovertex; head with reticulate sculpture; ocelli forming angle of ~ 90°; OCL ~ 1.7× diameter of posterior ocellus; OOL ~0.6× diameter of posterior ocellus; POL ~ 3.8× diameter of posterior ocellus; mandible with one tooth and a broad truncation; antenna with scape ~ 4.9× as long as wide; pedicel ~ 2.0× as long as wide; all funicular segments longer than wide; clava 3-segmented, 2.5× as long as wide, slightly shorter than F4–F6 combined. Relative measurements: HW 32; HL 14; FV 9.7; OOL 0.8; POL 7.2; OCL 2.4; SW 3.1; SL 14.

Mesosoma. Dorsum distinctly convex; MSW ~ 1.5× MSL; scutellum ~ 1.1× as long as wide; mesoscutum dorsally with reticulate sculpture similar to that on frontovertex; sculpture on scutellum similar to that on mesoscutum but clearly deeper; fore wings ~ 2.2× as long as wide; marginal vein quadrate; postmarginal vein short, ~ 1.3× as long as wide; stigmal vein 4.9–as long as wide, STV

~ 3.3× PMV; mid tibial spur 0.7× as long as basitarsus. Relative measurements: FWL 74; FWW 33.

Metasoma slightly longer than mesosoma; cercal plates located in posterior 3/5 of metasoma; hypopygium reaching ~3/4 of metasoma; ovipositor slightly exserted; OL ~ 6.1× GL, and 1.2× MT.

Male. Body length ~ 1.1 mm, generally similar to female, but mesoscutum with coppery sheen; ocelli forming an obtuse-angled triangle; clava unsegmented.

Variation. A little variation was found in coloration of the scape: the scape is not always totally dark brown, sometimes the base is yellow (Fig. 5A).

Host. Unknown.

Distribution. China (Guangxi, Hainan, Yunnan).

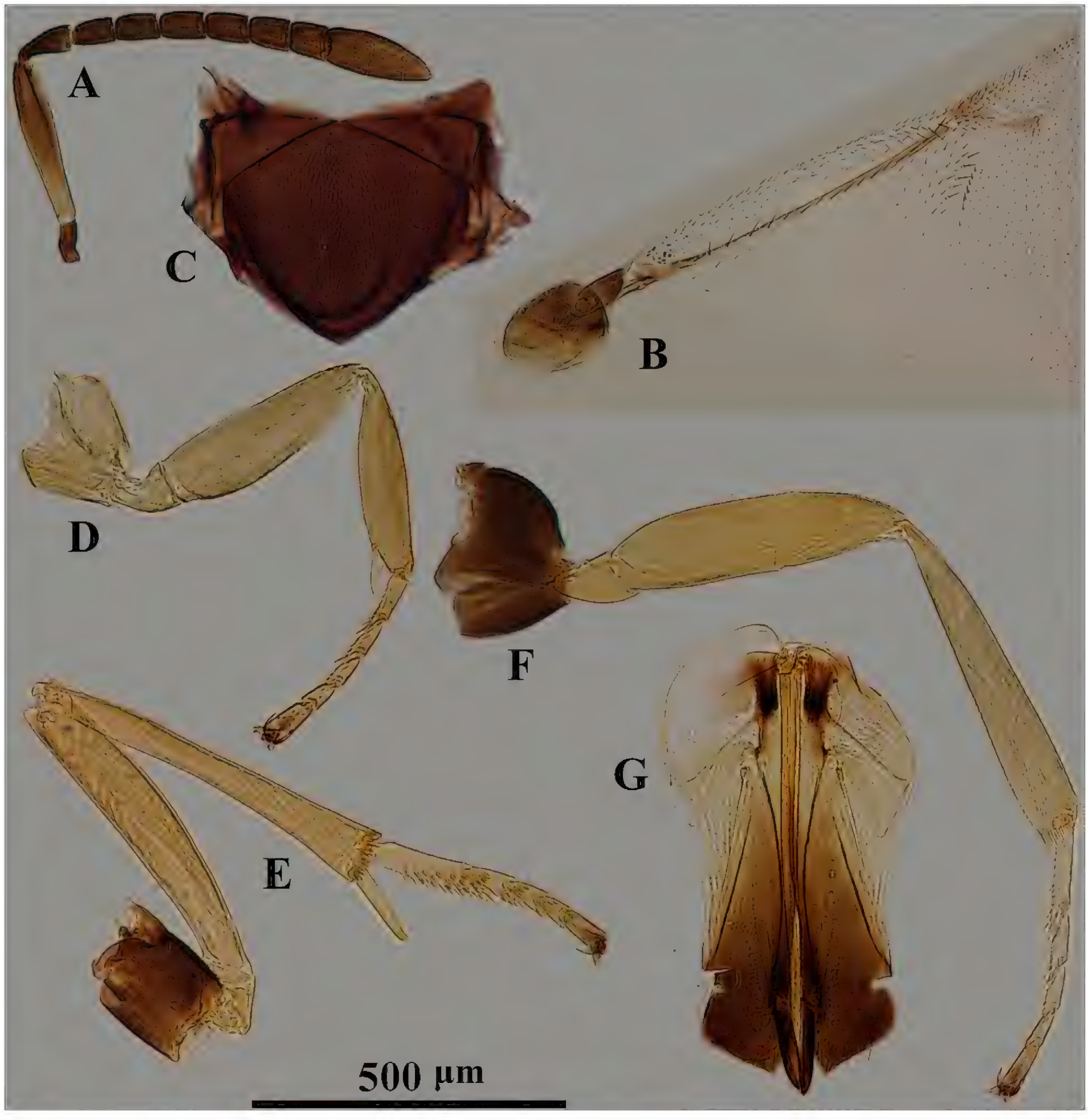


Figure 5. *Psyllaephagus densiciliatus* ♀ **A** antenna **B** fore wing **C** scutellum **D** fore leg **E** mid leg **F** hind leg **G** ovipositor.

Psyllaephagus elaeagni Trjapitzin, 1967

Fig. 6

Psyllaephagus elaeagni Trjapitzin, 1967: 192. Holotype ♀, Armenia (ZISP), not examined.
Psyllaephagus bachardenicus Myartseva, 1980: 50. Holotype ♀, Turkmenistan (ZISP). Synonymized by Japoshvili and Noyes (2005: 141).
Psyllaephagus rubriscutellatus Myartseva, 1981: 14. Holotype ♀, Turkmenistan (ZISP). Synonymized by Japoshvili and Noyes (2005: 141).
Psyllaephagus elaeagni: Tang et al. 2016: 65.

Material examined. China – **Xinjiang** • 7♀♀, Qitai, 29.July.2012, leg. HY HU's group; 2♀♀, Hoboksar, 26.July.2014, leg. HY HU's group; 11♀♀, Mori, 29.July.2016, leg. HY HU's group.

Diagnosis. Female. Mid and hind coxae dark brown, hind femur dark brown, basal of hind tibia with dark brown (Fig. 6F); F2–F5 longer than wide, F1 and F6 quadrate (Fig. 6A); mesoscutum and scutellum with contrasting sculpture, somewhat deeper than that on mesoscutum (Fig. 6C); metasoma approximately as long as mesosoma, OL ~ 1.3× MT.

Description. See Tang et al. (2016).

Host. Unknown.

Distribution. China (Xinjiang); other countries: Armenia, Turkmenistan, Kazakhstan.

Psyllaeohagus guangxinesis Zu, 2021

Fig. 7

Psyllaeohagus guangxinesis Zu, in Wu et al. 2021: 1–10. Holotype ♀, China, Guangxi (TJAU), examined by BYZ.

Material examined. China – **Guangxi** • Holotype ♀, Guilin, 29.Aug.2018, ex. *Macrohomotoma sinica* on *Ficus concinna*, leg. GH Zu & Y Chen (TJAU); **Yunnan** • 35♀♀, 9♂♂, Mengla, 16.May.1973, ex. *Macrohomotoma gladiatean* on *Ficus* sp., leg. DX Liao; **Fujian** • 5♀♀, 3♂♂, Huian, 16.Apr.2017, ex. *Macrohomotoma gladiatean* on *Ficus* sp., leg. YG Qin & M Xiong; **Jiangxi** • 21♀♀, 17♂♂, Ganzhou, 20.Jul.2021, ex. *Macrohomotoma gladiatean* on *Ficus* sp., leg. YZ Zhang; **Sichuan** • 5♀♀, 3♂♂, Chengdu, 21.Jun.2018, ex. *Macrohomotoma gladiatean* on *Ficus* sp., leg. HL Li.

Diagnosis. Female. Body length ~ 2.3 mm; legs yellow, but sometimes basal 1/3 of all hind femora dark brown (Fig. 7D); scape strongly flattened and expanded, less than 2.5× longer than broad (Fig. 7A); metasoma ~ 1.3× longer than mesosoma; ovipositor exserted, exserted part ~ 1/2 of metasoma; OL ~ 3.8× MT.

Variation. A little variation was found in coloration of the mid and hind coxae: the mid coxa is not always completely yellow, sometimes the base can be dark brown (Fig. 7C); the hind coxa varies from partly to totally dark brown (Fig. 7D).

Description. See Wu et al. (2021).

Hosts. *Macrohomotoma sinica* Yang & Li, 1984 (Hemiptera: Homotomidae).

Distribution. China (Guangxi, Guangdong, Jiangxi, Yunnan, Fujian).

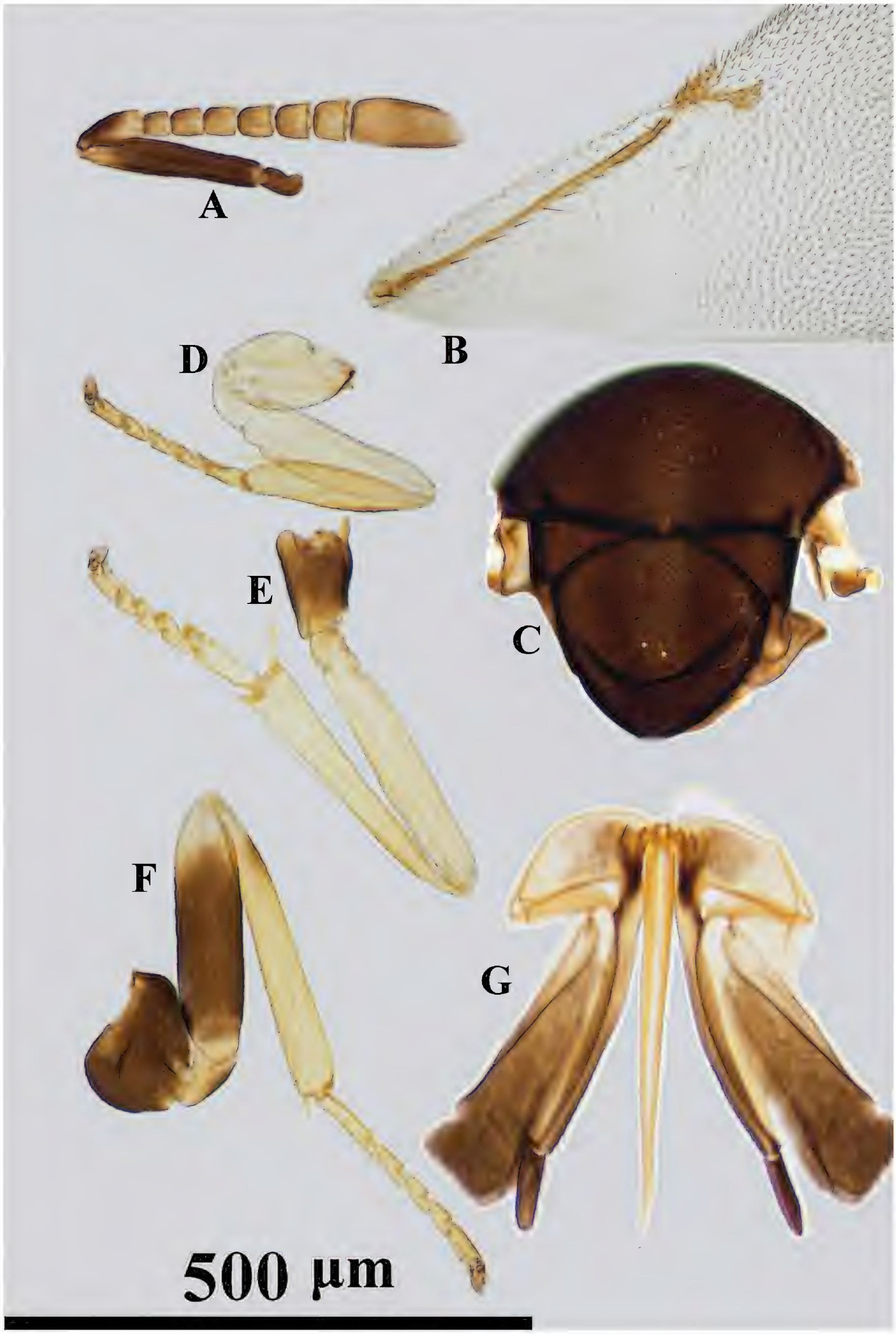


Figure 6. *Psyllaephagus elaeagni* ♀ **A** antenna **B** fore wing **C** mesonotum **D** fore leg **E** mid leg **F** hind leg **G** ovipositor.

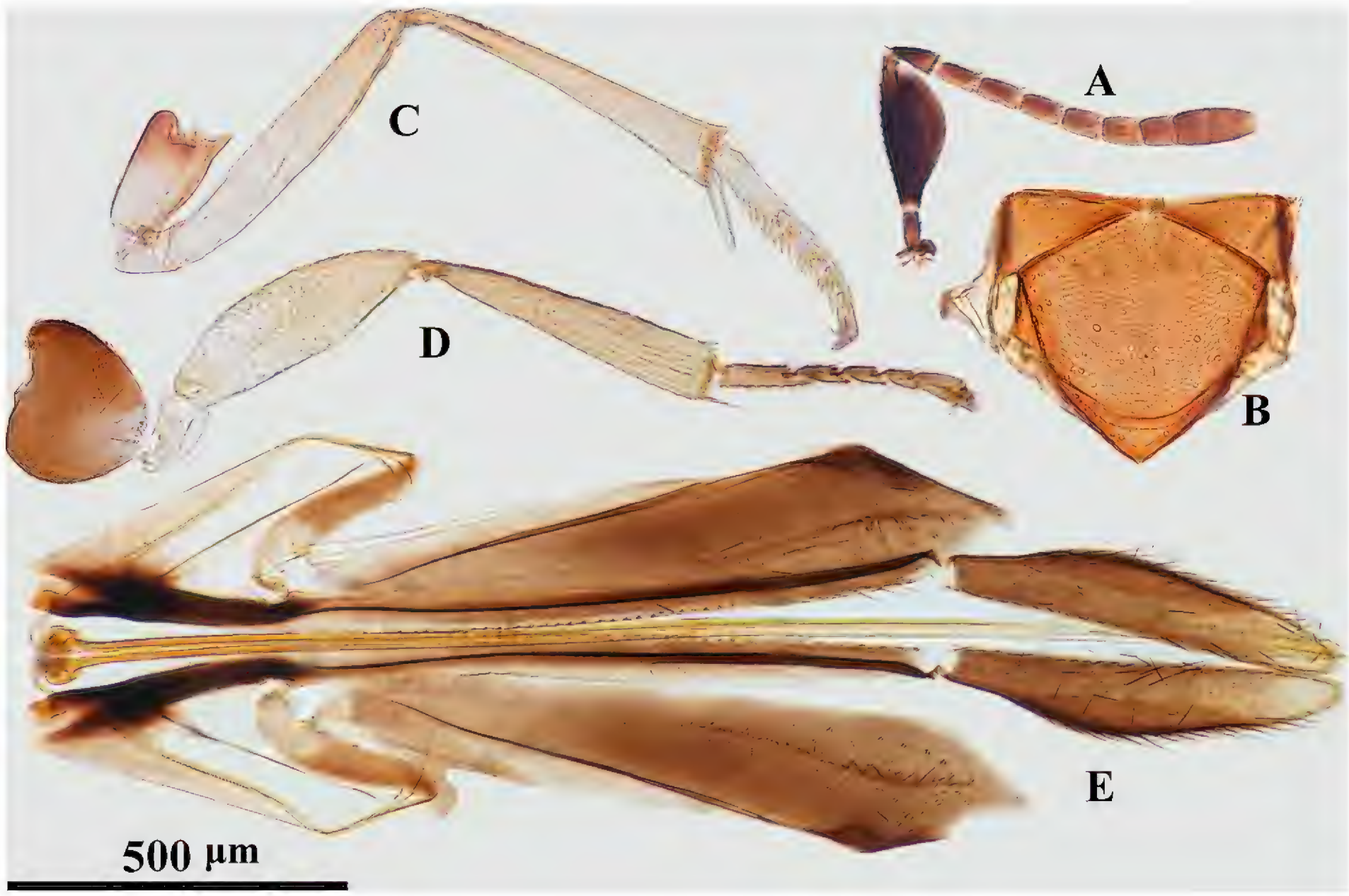


Figure 7. *Psyllaeohagus guangxinesis* ♀ **A** antenna **B** scutellum **C** mid leg **D** hind leg **E** ovipositor.

***Psyllaephagus latiscapus* Xu, 2000**

Figs 8–10, 11

Psyllaephagus latiscapus Xu, in Xu et al. 2000a: 39. Holotype ♀, China, Zhejiang (ZUIE), examined by YZZ.

Psyllaephagus latiscapus Xu: Tang et al. 2016: 69; Wu et al. 2021: 7.

Material examined. China – **Zhejiang** • ***Holotype*** ♀, Hangzhou, 26.V.1957, ex. *Pachypsylla celtidisgemma*, 5720-9, lge. QH Chen (ZUIE); **Shandong** • 4♀♀, 1♂, Qingdao, 24 Oct. 1962, ex. *Pachypsylla celtidisgemma* on *Celtis sinensis*, leg. QH Chen.

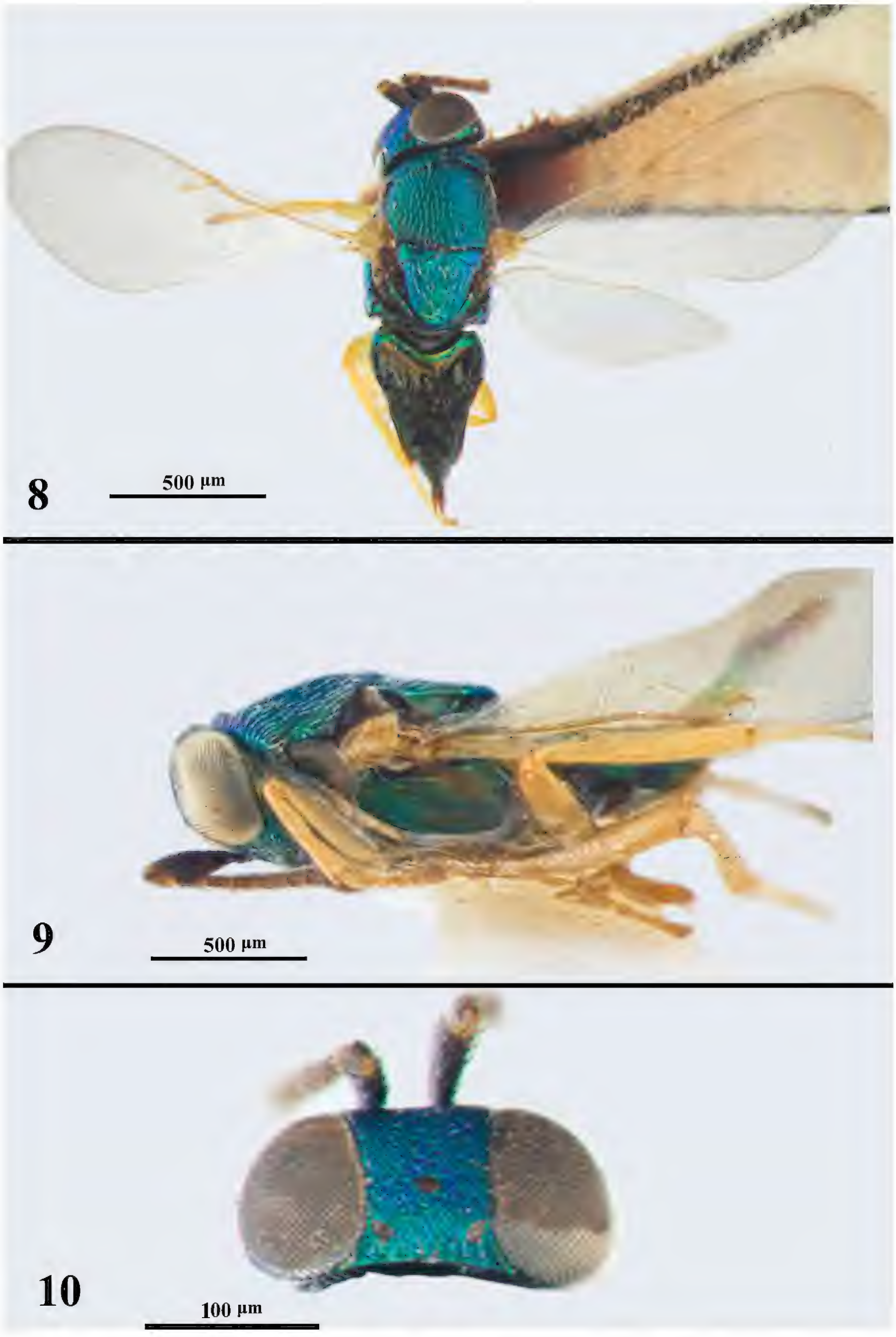
Diagnosis. Female. Body length ~ 2.0 mm, head with metallic blue; tegulae entirely pale yellow; antenna with scape strongly expanded, ~ 2.3× as long as wide (Fig. 11A); postmarginal vein nearly as long as stigmal vein (Fig. 8); mid and hind coxae dark brown; ovipositor exserted, the exserted part ~ 1/5 of metasoma. OL ~ 1.5× MT.

Description. See Xu et al. (2000a).

Host. *Pachypsylla celtidisgemma* Riley, 1885 (Hemiptera: Aphalaridae).

Distribution. China (Zhejiang, Shandong, Fujian, Yunnan).

Comments. The material above was treated as *P. punctatus* by Zhang (2001) in his thesis, which was not formally published but later cited by Tang et al. (2016) and Wu et al. (2021).



Figures 8–10. *Psyllaephagus latiscapus* ♀ **8** body in dorsal view **9** body in lateral view **10** head in dorsal view.

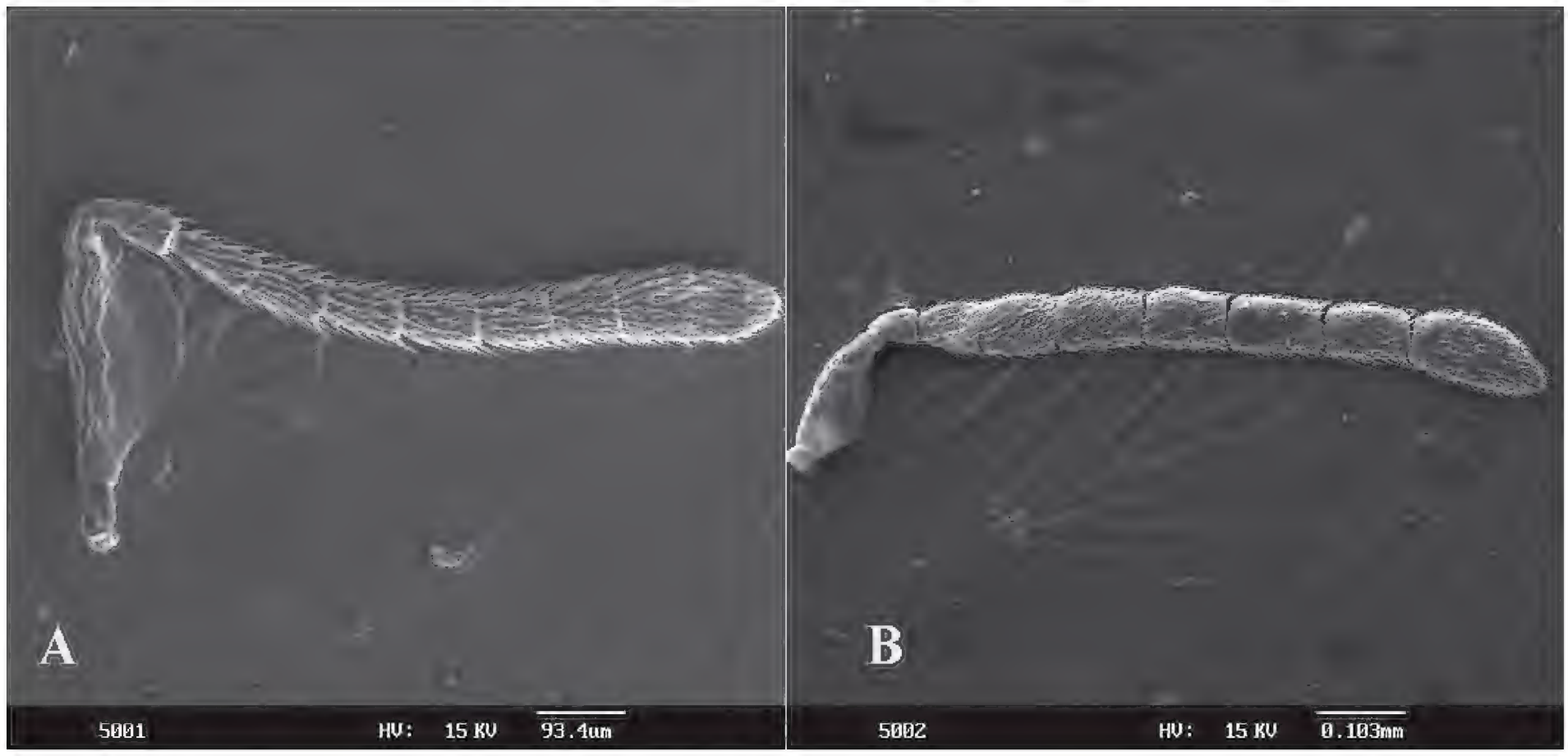


Figure 11. *Psyllaephagus latiscapus* **A** antenna ♀ **B** antenna ♂.

***Psyllaephagus longifuniculus* Xu, 2000**

Fig. 12

Psyllaephagus longifuniculus Xu, in Xu et al. 2000: 40. Holotype ♀, Shaanxi (ZUIE), examined by YZZ.

Material examined. China – **Shanxi** • ***Holotype*** ♀, Wugong, 21.Aug.1954, Dept. Plant Protection, Northwest Agric. Univ., ex. *Thysanogyna limbata*, C5526-1a (ZUIE); China – **Zhejiang** • 6♀♀, Lishui, 16.Jun.1981, leg. DX Liao; **Beijing** • 8♀♀, 5♂♂, 11.Nov.1995, ex. *Thysanogyna limbata*, leg. YZ Zhang; 9♀♀, 13♂♂, 09.Jun.2017, ex. *Thysanogyna limbata*, leg. YZ Zhang.

Diagnosis. Female. All coxae dark brown; F1 at least as long as or slightly longer than pedicel; F1–F5 obviously longer than broad, F6 slightly longer than broad or subquadrate (Fig. 12A); OL ~ 1.5× MT.

Description. Female. ***Body*** length ~ 2.2 mm, with blue green sheen; basal 1/2 of tegula pale yellow, the rest dark brown; antenna completely dark brown; all coxae dark brown; hind femur dark brown, but apical ~ 2/5 yellow; wings hyaline, venation brown (Fig. 12B).

Head with reticulate sculpture, HW ~ 3.0× HL in dorsal view, 2.9× as wide as frontovertex; ocellus forming an obtuse triangle, angle slightly more than 90°; OCL ~ 0.8× diameter of posterior ocellus; OOL ~ 1.1× diameter of posterior ocellus; POL ~ 4.0× diameter of posterior ocellus; mandible with one tooth and a broad truncation; antenna with scape slightly expanded and ~ 4.8× as long as wide; pedicel ~ 1.8× as long as wide; F1–F5 longer than broad, F6 quadrate; clava 3-segmented, approximately as long as F4–F6 combined, nearly 3.0× as long as wide (Fig. 12A). Relative measurements: SL 14.4; SW 3.

Mesoscutum slightly convex; mesoscutum and scutellum with reticulate sculpture similar to that on frontovertex; MSW ~1.5× MSL, and the center of the posterior margin protrudes backward to cover junction of axillae; marginal vein subquadrate, slightly longer wide, stigmal vein ~ 6.5× as long as wide, postmar-

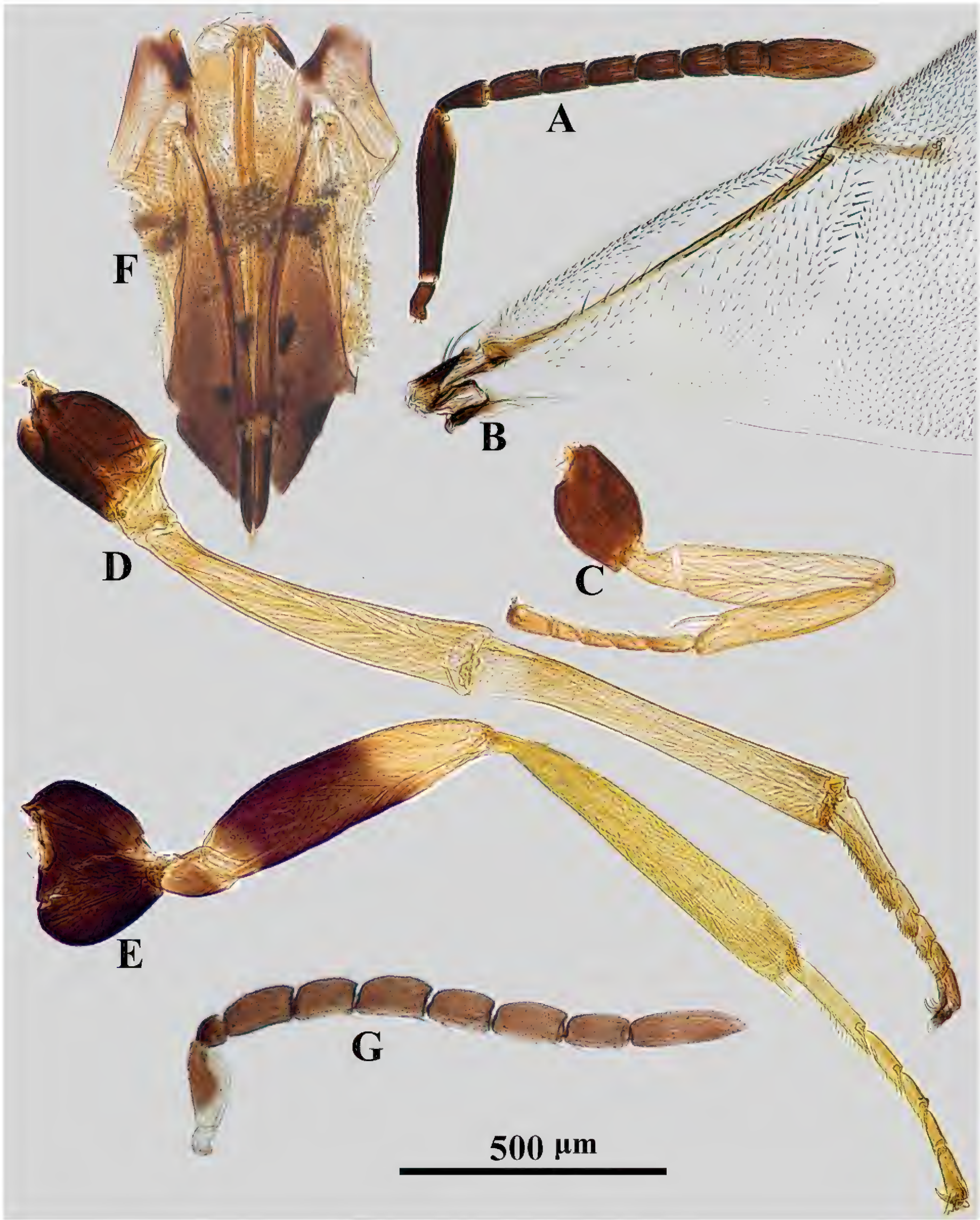


Figure 12. *Psyllaephagus longifuniculus* **A** antenna ♀ **B** fore wing ♀ **C** fore leg ♀ **D** mid leg ♀ **E** hind leg ♀ **F** ovipositor ♀ **G** antenna ♂.

ginal vein ~ 2.7× as long as wide, PMV ~ 0.4× STV; mid tibia spur 0.9×–as long as basitarsus. Relative measurements: FWL 64; FWW 27.

Metasoma slightly shorter than mesosoma; cercal plates located at the halfway point of the metasoma; hypopygium with apex reaching ~ 2/3 of metasoma; ovipositor not exserted; OL ~ 5.3× GL, and 1.2× MT.

Male. Body length ~ 1.6 mm; generally similar to female except color and structure of antenna, antenna pale brown, scape and pedicel short, funicular segments protrude laterally, clava unsegmented (Fig. 12G).

Variation. In *P. longifuniculus*, a little variation was found in lengths of F1 and F6: F1 is not always shorter than the pedicel, sometimes it is ~ 1.1× as long as pedicel; F6 is sometimes quadrate (Fig. 12A).

Host. *Thysanogyna limbata* Enderlein, 1926 (Hemiptera: Carsidaridae).

Distribution. China (Beijing, Shaanxi, Zhejiang).

Psyllaephagus longiventris **Trjapitzin, 1964**

Fig. 13

Psyllaephagus longiventris Trjapitzin, 1964: 237. Holotype ♀, Kazakhstan (ZISP), not examined.

Kaszabicyrtus acutigastris Szelényi, 1971: 390–391, Holotype ♀, Mongolia. Synonymized by Szelényi (1972: 372).

Psyllaephagus longiventris: Myartseva 1984: 143, 235–236; 1986: 216, 255, 257; Tang 2016: 70–72.

Material examined. CHINA – **Xinjiang** • 7♀♀, 2♂♂, Turpan, 03.Aug.2012, leg. HY Hu group; 11♀♀, 5♂♂, Xinjiang, Turpan, 11.Aug.2012, leg. HY Hu group. 5♀♀, Altai, 11.June.2023, leg. BY Zou.

Diagnosis. Female. Legs yellow, but mid and hind coxae dark brown; ocelli forming right triangle; mandible with two teeth and a truncation (Fig. 13C); F1–F5 longer than broad (Fig. 13A); metasoma almost 2.0× as long as mesosoma; the ovipositor protrudes ~ 2/5 of metasoma (Fig. 13H); OL ~ 1.6× MT.

Description. See Tang et al. (2016).

Host. *Caillardia robusta* Loginova, 1956 (Hemiptera: Aphalaridae).

Distribution. China (Xinjiang); other countries: Kazakhstan, Mongolia, Turkmenistan, Uzbekistan.

Psyllaephagus obliquus **Zou & Zhang, sp. nov.**

https://zoobank.org/F91EE53B-2AFB-4614-A7E8-19731147E1F6

Fig. 14

Type material. ***Holotype*** ♀ [on slide], CHINA – **Guizhou**, Zunyi, 28.Aug.2017, ex *Edentatipsylla shanghaiensis*, leg. YZ Zhang and YG Qin (deposited in IZCAS). ***Paratypes*** 10♀♀, 2♂♂, same data as holotype.

Diagnosis. Female. Body length ~ 1.5 mm; all coxae dark brown and hind femora; scape distinctly expand, ~ 3.2× as long as wide; F6 transverse; clava strongly obliquely truncated at apex (Fig. 14A); OL ~ 1.4× MT.

Description. Female. ***Body*** length ~ 1.8 mm, with blue-green sheen; basal ~ 1/2 of tegula yellow, remainder dark brown; scape nearly completely dark brown; pedicel dark brown except apex yellow; funiculus from dark brown to yellow brown; clava yellowish brown; all coxae, hind femur except apices dark brown; wings hyaline, venation brown (Fig. 14B).

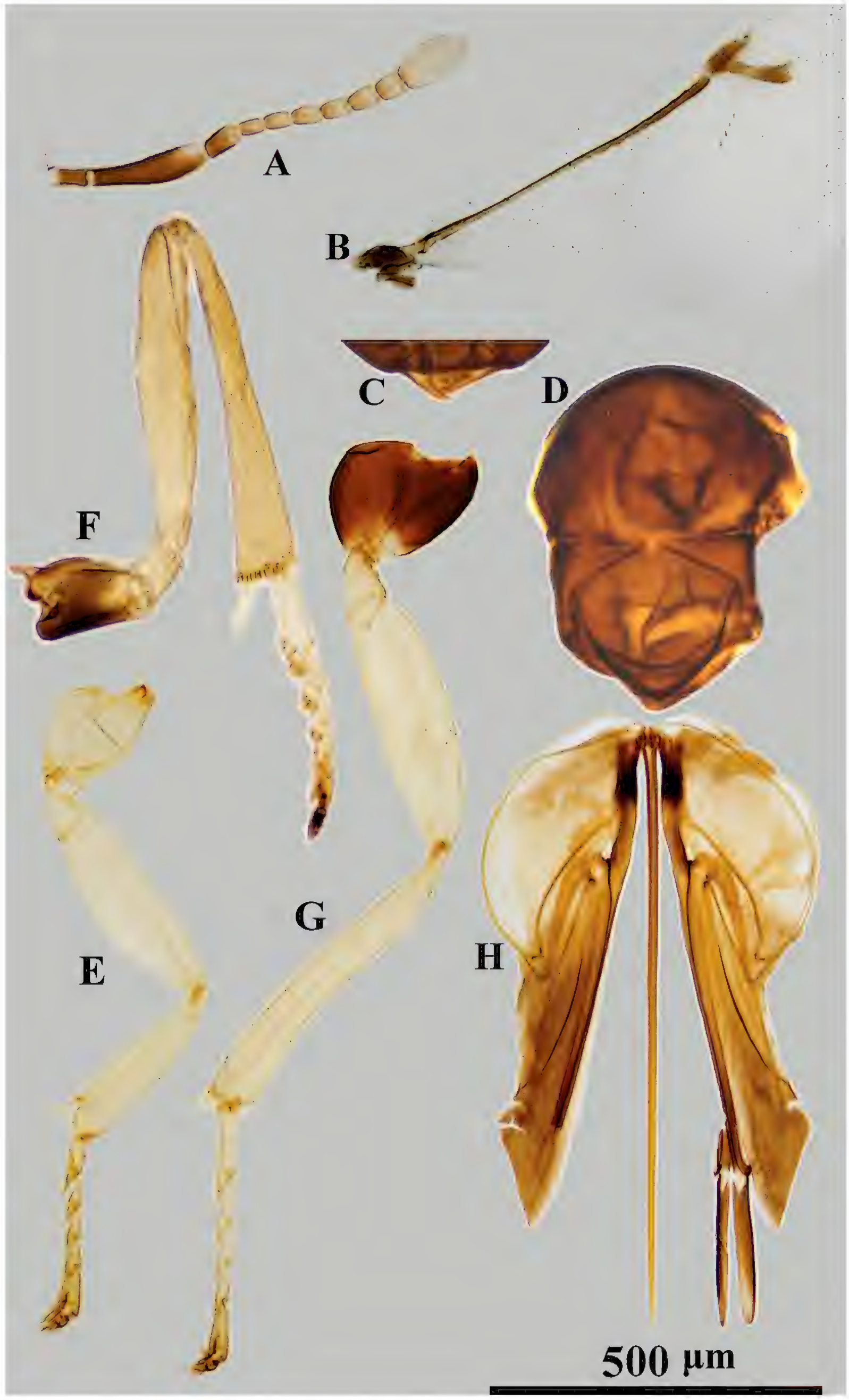


Figure 13. *Psyllaephagus longiventris* ♀ **A** antenna **B** mandible **C** fore wing **D** mesonotum **E** fore leg **F** mid leg **G** hind leg **H** ovipositor.

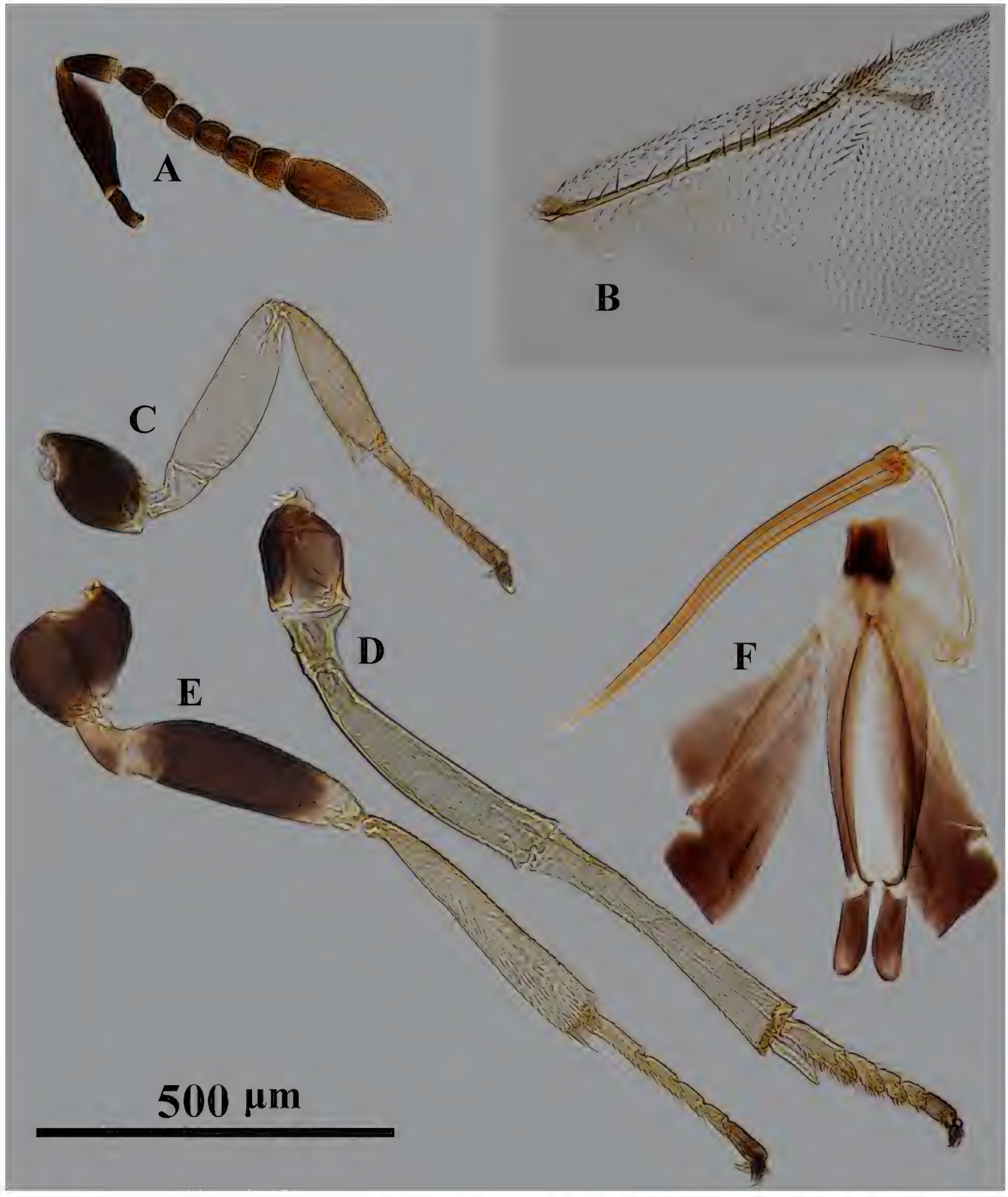


Figure 14. *Psyllaephagus obliquus* sp. nov. ♀ **A** antenna **B** fore wing **C** fore leg **D** mid leg **E** hind leg **F** ovipositor.

Head with reticulate sculpture, HW ~ 2.2× the HL in dorsal view, and ~ 2.8× wide as frontovertex; ocellus forming an angle ~ 100°; OCL ~ 1.2× diameter of posterior ocellus; OOL ~ 0.4× diameter of posterior ocellus; POL ~ 3.6× diameter of posterior ocellus; mandible with two teeth and a broad truncation; upper margin of torulus upper than lower margin of eye; scape distinctly expanded, ~ 3.2× as long as wide; pedicel ~ 2.7× as long as wide, approximately as long as F1 and F2 combined; F1 longer than broad, F2–F5

subquadrate, F6 almost wider than long; clava 3-segmented, nearly 2.2× as long as wide, approximately as long as F4–F6 combined; the apex of clava strongly obliquely truncated (Fig. 14A), the truncated parts ~ 1/2 clava length. Relative measurements: HW 21; HL 9; FV 7.5; OOL 0.8; POL 7.2; OCL 2.4; SW 2.6; SL 9.

Mesoscutum slightly convex; mesoscutum and scutellum with reticulate sculpture similar to that on frontovertex; MSW ~ 1.4× MSL; scutellum and mesoscutum dorsally with reticulate sculpture similar to that on frontovertex; marginal vein ~ 1.3× as long as wide; stigmal vein ~ 4.1× as long as wide, postmarginal vein ~ 2.0× as long as wide, PMV ~ 0.3× of STV; mid tibia spur 0.8× as long as basitarsus. Relative measurements: FWL 50; FWW 22.

Metasoma approximately as long as mesosoma; cercal plates located in the 1/2 of metasoma; hypopygium reaching ~ 3/4 of metasoma; ovipositor slightly exserted; OL ~ 5.3× GL, and 1.4× MT.

Male. Length 1.6–1.8 mm; generally similar to female in body coloration, except the antenna yellow; clava and flagellum have long bristles.

Host. *Edentatipsylla shanghaiensis* Li & Chen, 2008 (Hemiptera: Psyllidae).

Distribution. China (Guizhou, Shanghai).

Etymology. The specific name refers to its strongly obliquely truncated clava.

Comments. Using the key of Trjapitzin (1989), the species runs to *P. stenopsyllae* (Tachikawa, 1963), but can be separated from *P. stenopsyllae* by a combination of the following characters: scape ~ 3.2× as long as wide (in *P. stenopsyllae*, scape ~ 3.7× as long as wide); F2–F5 quadrate, F6 transverse (in *P. stenopsyllae*, F2–F5 obviously longer than wide, F6 quadrate); clava approximately as long as F4–F6 combined and the apex of clava strongly obliquely truncated (in *P. stenopsyllae*, clava slightly shorter than F4–F6 combined, and with apex more or less rounded). *Psyllaephagus obliquus* is similar to *P. nipponicus* (Ishii, 1928) but can be separated from *P. nipponicus* by pedicel ~ 2.5× as long as wide (in *P. nipponicus*, pedicel ~ 2× as long as wide); F1 ~ 1.2× as long as wide (in *P. nipponicus*, F1 quadrate); metasoma as long as mesosoma (in *P. nipponicus*, metasoma shorter than mesosoma).

Psyllaephagus ogazae Sugonjaev, 1968

Fig. 15

Psyllaephagus ogazae Sugonjaev, 1968: 593. Holotype ♀, Uzbekistan (ZISP), not examined.

Psyllaephagus ogazae: Trjapitzin, 1989: 260; Tang et al. 2016: 76.

Material examined. China – **Xinjiang** • 18♀♀, 7♂♂, Hoboksar, 29.Jul.2012, ex *Caillardia notata* on *Haloxylon ammodendron*, leg. HY Hu's group; 23♀♀, 9♂♂, Hoboksar, 06.Jun.2016, ex. *Caillardia notata* on *Haloxylon* sp., leg. HY Hu's group; 11♀♀, Fukang, 03.Jun.2018, leg. HY Hu's group.

Diagnosis. Female. Body length 1.5–2.2 mm, with coppery green sheen; legs including all coxae, femora, and tibiae dark brown; ocelli forming a right-angled triangle; marginal vein and postmarginal vein almost absent (Fig. 15B); metasoma short, ~ 0.6–as long as mesosoma; OL ~ 6× GL, and 1.2× MT.

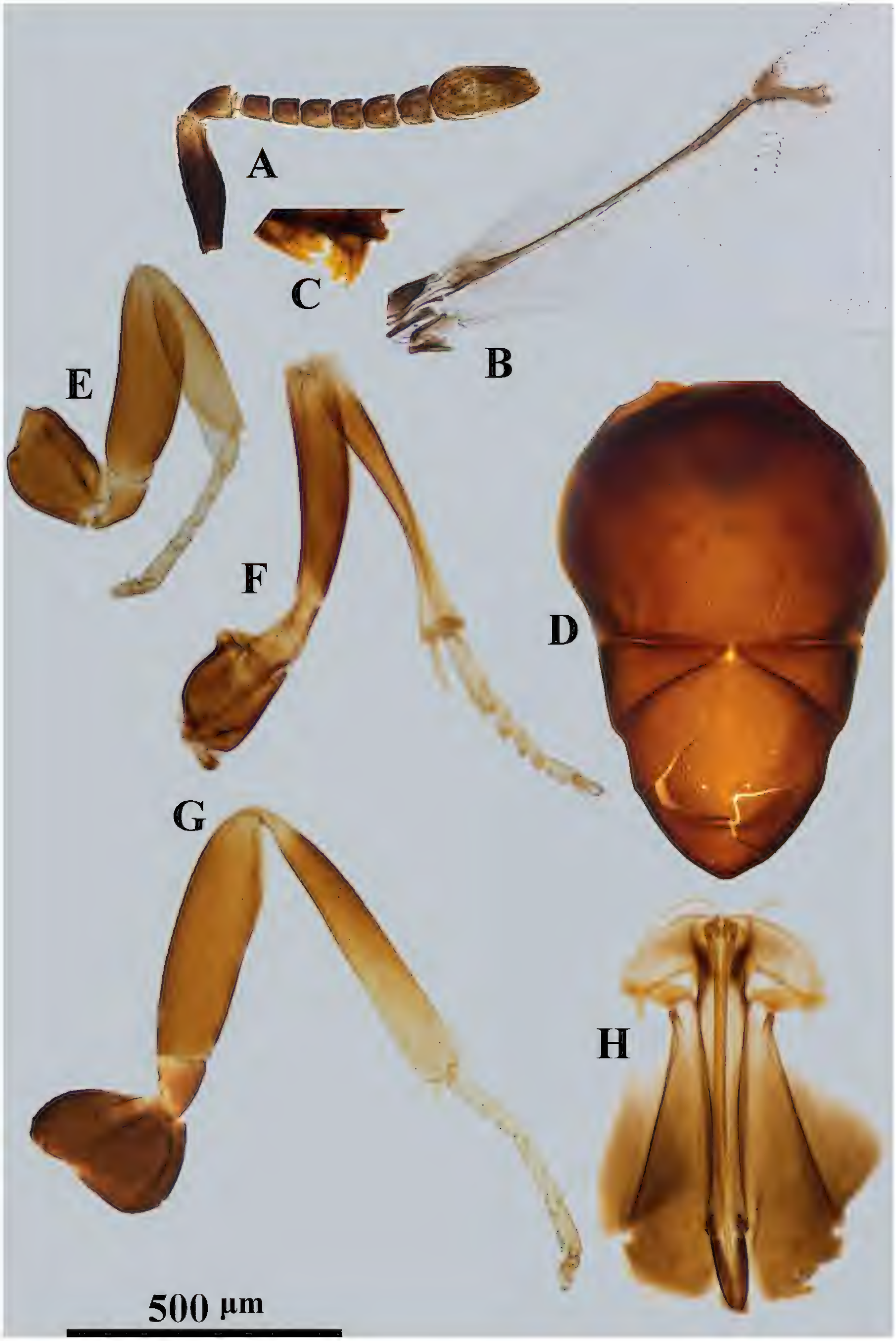


Figure 15. *Psyllaephagus ogazae* ♀ **A** antenna **B** mandible **C** fore wing **D** mesonotum **E** fore leg **F** mid leg **G** hind leg **H** ovipositor.

Description. See Tang et al. (2016).

Variation. Very little variation seen in our material: the hind tibia is not always dark brown, sometimes the apical 1/3 might be brownish yellow (Fig. 15G).

Host. *Caillardia robusta* Loginova, 1956 (Hemiptera: Aphalaridae).

Distribution. China (Xinjiang); other countries: Kazakhstan, Mongolia, Tajikistan, Turkmenistan, Uzbekistan.

***Psyllaephagus stenopsyllae* (Tachikawa, 1963)**

Fig. 16

Metaprionomitus stenopsyllae Tachikawa, 1963: 182. Holotype ♀, Japan, not examined.

Psyllaephagus stenopsyllae: Trjapitzin 1967: 177; Tan and Zhao 1999: 175; Xu et al. 2000: 9; Japoshvili et al. 2016: 392.

Material examined. CHINA – **Jiangxi** • 6♀♀, Ganzhou, 15.Oct.2012, ex. *Macrohomotoma sinica*, leg. DY Huang; **Fujian** • 7♀♀, 2♂♂, Huian, 20.May.2012, ex. *Macrohomotoma gladiatean* on *Ficus* sp., leg. YZ Zhang; **Sichuan** • 17♀♀, 3♂♂, Chengdu, 21.Jun.2018, ex. *Macrohomotoma gladiatean* on *Ficus* sp., leg. YZ Zhang.

Diagnosis. Female. Body length ~ 2.0 mm; all coxae and hind femora dark brown (Fig. 16D–F); scape slightly expanded at apex; clava slightly short than F3–F6 combined (Fig. 16A); ovipositor exserted, exserted part ~ 1/5 metasomal length (Fig. 16G); OL ~ 1.9× as long as MT.

Description. Female. ***Body*** length ~ 2.2 mm, head with metallic green sheen; mesoscutum and scutellum with bluish violet sheen; metasoma with coppery sheen; basal ~ 1/4 of tegula pale yellow, the remainder dark brown; antenna completely dark brown; all coxae dark brown; hind femur dark brown, but apical ~ 1/4 yellow; wings hyaline, venation brown (Fig. 16B).

Head with reticulate sculpture, HW ~ 3.3× the HL in dorsal view, 3.1× wide as frontovertex; ocellus forms an obtuse triangle, angle ~ 110°; OCL ~ 1.0× diameter of posterior ocellus; OOL ~ 1.1× diameter of posterior ocellus; POL ~ 4.0× diameter of posterior ocellus; mandible with one tooth; scape slightly expanded and ~ 4.3× as long as wide; pedicel ~ 1.8× as long as wide; F1–F5 longer than broad, F6 quadrate; clava 3-segmented, nearly 2.3× as long as wide, shorter than F4—F6 combined. Relative measurements: SL 10.9; SW 2.5.

Mesoscutum slightly convex; mesoscutum and scutellum with reticulate sculpture similar to that on frontovertex; MSW ~ 1.4× as MSL; marginal vein subquadrate, slightly longer wide, stigmal vein ~ 7.2× as long as wide, postmarginal vein ~ 1.6× as long as wide, PMV ~ 0.7× STV; mid tibia spur 0.8× as long as basitarsus. Relative measurements: FWL 51.6; FWW 36.3.

Metasoma nearly as long as mesosoma; cercal plates located in middle of metasoma; hypopygium with apex reaching ~ 2/3 of metasoma; ovipositor exserted, exserted part of ovipositor ~ 0.1× as long as metasoma; OL ~ 4.8× GL, and 1.9× MT.

Hosts. *Macrohomotoma gladiatuum* Kuwayama, 1908, *Stenopsylla nigricornis* Kuwayama, 1910, *Trioza syzygii* Li & Yang, 1911 (Hemiptera: Triozidae).

Distribution. China (Fujian, Hainan, Jiangxi, Taiwan); other countries: Japan, Iran.

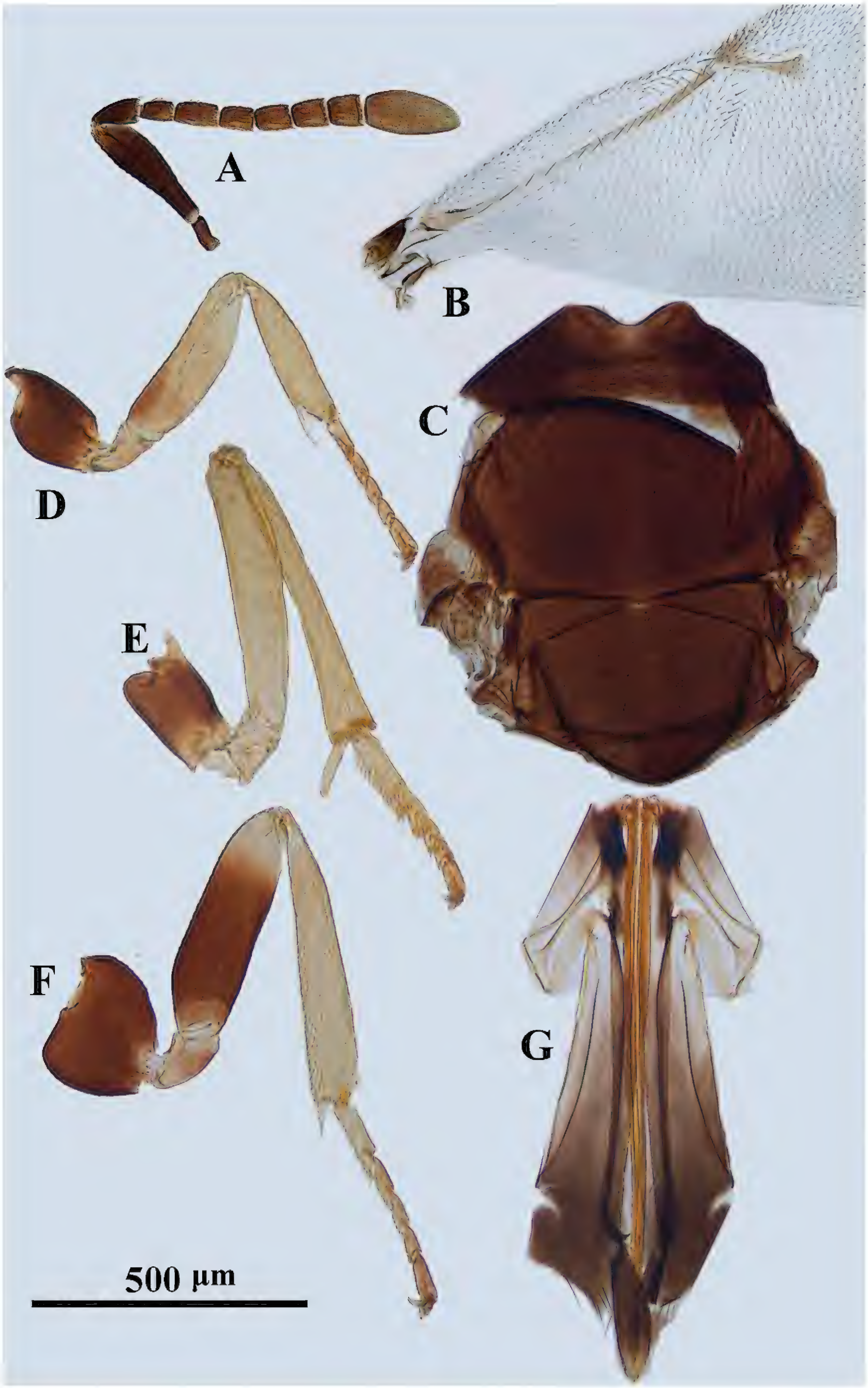


Figure 16. *Psyllaephagus stenopsyllae* ♀ **A** antenna **B** fore wing **C** mesonotum **D** fore leg **E** mid leg **F** hind leg **G** ovipositor.

Psyllaephagus tangae **Zou & Zhang, sp. nov.**
https://zoobank.org/04605f95-6f37-4b6f-be56-2f0fe70cb867
Fig. 17

Psyllaehagus nikolskajae Trjapitzin: Tang et al. 2016: 74 (misidentification).

Type material. ***Holotype*** ♀ [on slide], China – Xinjiang, Changji, 21.Jul.2012, by sweeping, leg. HY Hu's group (deposited in ICXU); ***Paratypes*** 11♀♀, same data as holotype.

Diagnosis. Female. Body length ~ 1.0 mm; all coxae dark brown, hind femur dark brown; F4 smaller than F3 in size (Fig. 17A); clava longer than F3–F5 combined; sculpture of scutellum with large cells in basal half and small cells near apex (Fig. 17C); OL ~ 1.2× MT.

Description. Female. ***Body*** length ~ 1.0 mm, with greenish blue sheen; head and face generally dark with blue reflections; axillae with purple sheen; mesoscutum, axillae, and scutellum with bronze sheen; tegula entirely yellow; scape dark brown except apex yellow; basal 1/2 of pedicel dark brown, the remainder yellow; funiculus yellow; all coxae dark brown; hind femur dark brown but yellow at apex (Fig. 17D–F); wings hyaline, venation brown.

Head with reticulate sculpture HW ~ 2.5× FV, HW ~ 3.2× HL, head finely reticulate, overlaid with regularly spaced shallow punctuations; ocelli forming an obtuse triangle, angle ~ 120°; OCL ~ 0.9× diameter of posterior ocellus; OOL ~ 0.6× diameter of posterior ocellus; mandible with two teeth and a broad truncation; antenna with scape 5.0× as long as wide; pedicel ~ 1.6× as long as wide; F1–F4 broader than long, F5 subquadrate, F6 quadrate; clava 3-segmented but not obvious; mandible with two teeth and a broad truncation. HW 17; HL 5.3; FV 7; OCL 1.4; OOL 0.96; SL 7.2; SW 1.4.

Mesoscutum distinctly convex; dorsally with reticulate sculpture similar to that on frontovertex; sculpture of scutellum with large cells in basal half and small cells near apex; marginal vein punctiform, slightly longer than wide; postmarginal vein ~ 1.5× as long as wide; stigmal vein 4.7× as long as wide, STV ~ 3.0× PMV; mid tibia spur ~ 0.6× as long as basitarsus. FWL 31.6; FWW 18.1.

Metasoma slightly shorter than mesosoma; cercal plates located in the posterior 1/2 of metasoma; hypopygium with apex reaching ~ 2/3 of metasoma; ovipositor not exserted (Fig. 17G); OL ~ 5.6× GL, and 1.2× MT.

Male. Unknown.

Etymology. This species named after Miss Tang who contributed so much to the study of Encyrtidae.

Host. Unknown.

Distribution. China (Xinjiang).

Comments. This species had been erroneously treated as *P. nikolskajae* in Tang et al. (2016). Further study of the morphological characters indicate it is an undescribed species. Using the key of Trjapitzin (1989), the species runs to *P. tokgaevi* Myartseva but differs as follows: clava nearly as long as F2–F6 combined (in *tokgaevi*, clava approximately as long as F3–F6 combined); OL ~ 5.6× GL (in *tokgaevi*, OL ~ 4.5× GL). *Psyllaephagus tangae* is similar to *P. belanensis* but can be separated from *P. belanensis* by F4 smaller than F3 (in *P. belanensis*, F4 not smaller than F3 according to Trjapitzin 1968); F1 and F2

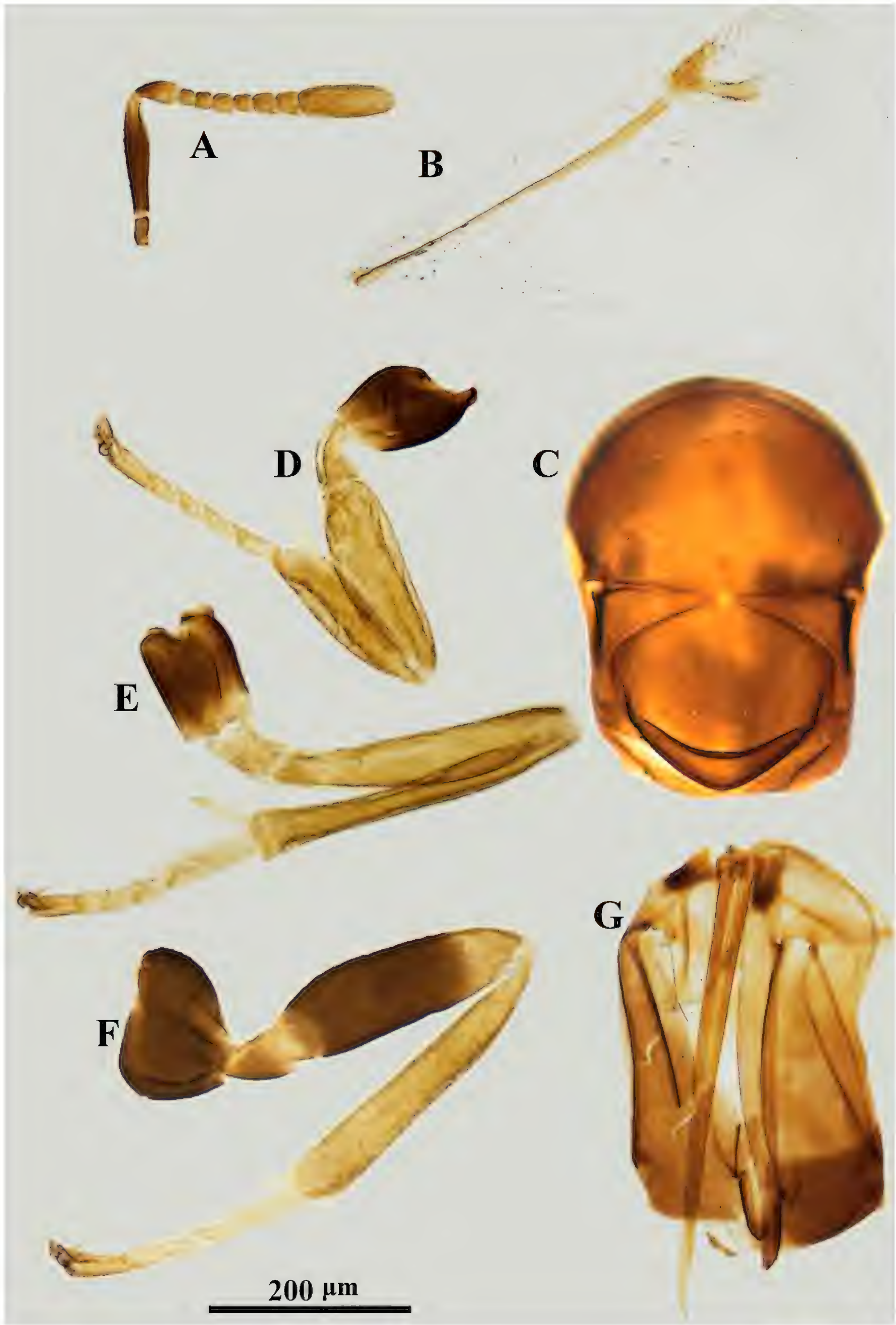


Figure 17. *Psyllaephagus tangae* sp. nov. ♀ **A** antenna **B** fore wing **C** mesonotum **D** fore leg **E** mid leg **F** hind leg **G** ovipositor.

quadrate (in *P. belanensis*, F1 and F2 longer than wide); head as wide as thorax (in *P. belanensis*, head distinctly wider than thorax).

Psyllaephagus taiwanus Xu, 2000

Psyllaephagus taiwanus Xu, in Xu et al. 2000b: 9–10. Holotype ♀, China, Taiwan (TARI), not examined.

Diagnosis. Female. Mid and hind coxae dark brown, hind femur and tibia dark brown, apical 1/3 of mid femora and basal 1/5 of mid tibia dark brown; clava as long as F3–F6 combined; sculpture of scutellum deeper and finer than that on mesoscutum; ovipositor slightly exserted.

Description. See Xu et al. (2000b).

Host. *Trioza syzygii* Li & Yang, 1911 (Hemiptera: Triozidae).

Distribution. China (Taiwan).

Key to Chinese species of *Psyllaephagus* (female)

1 All coxae dark brown (Fig. 14C–E); rarely apex of fore coxa yellow (Fig. 3D) **2**

– At least fore coxa yellow (rarely basally dark brown) **7**

2 All femora marked dark brown (Fig. 15E–G) **3**

– Only hind femur marked dark brown (Figs 12E, 16F, 17F) **4**

3 Postmarginal vein nearly absent (Fig. 15C); F1–F5 slightly longer than broad; clava ~ as long as F4–F6 combined (Fig. 15A) ..... ***P. ogazae* Sugonjaev**

– Postmarginal vein present, ~ 1/3 of stigmal vein length; all funicular segments transverse, clava ca as long as F3–F6 combined (Fig. 3A) ..... ***P. clavus* Zou & Zhang, sp. nov.**

4 Clava longer than F3–F6 combined; F4 smaller than F3 (Fig. 17A) ..... ***P. tangae* Zou & Zhang, sp. nov.**

– Clava shorter than F3–F6 combined; F4 not smaller than F3 in size **5**

5 All funicular segments longer than wide; F1 as long as or slightly longer than pedicel; clava ~ 0.7× as long as F4–F6 combined (Fig. 12A) ..... ***P. longifuniculus* Xu**

– At least one funicular segment not longer than wide; F1 shorter than pedicel; clava not less than 0.8× F4–F6 combined **6**

6 Ovipositor distinctly exserted, the exserted part of ovipositor ~ 1/5 of metasoma (Fig. 16G); F1–F5 longer than wide, F6 subquadrate; clava slightly shorter than F4–F6 combined, and with apex more or less rounded (Fig. 16A) ..... ***P. stenopsyllae* Tchikawa**

– Ovipositor not or slightly exserted, the exserted part of ovipositor less than 1/6 of metasoma; clava as long as F4–F6 combined, and with apex strongly obliquely truncated (Fig. 14A) ..... ***P. obliquus* Zou & Zhang, sp. nov.**

7 Scape distinctly expanded, less than 2.5× as long as broad (Figs 7A, 11A) **8**

– Scape not or only slightly expanded, more than 3× as long as broad (Figs 6A, 13A) **9**

8 Metasoma ~ 1.25× as long as mesosoma; ovipositor strongly exserted, exserted part of ovipositor ~ 1/3 of metasoma (Fig. 7E) ..... ***P. guangxiensis* Zu**

– Metasoma ~ as long as mesosoma, ovipositor slightly exserted, exserted part of ovipositor ~ 1/4 of metasoma (Figs 8, 9) ..... ***P. latiscapus* Xu**

9 Metasoma nearly 2.0× as long as mesosoma; ovipositor obviously exserted, exserted part of ovipositor ~ 1/3 of metasoma (Fig. 13H) ..... ***P. longiventris* Trjapitzin**

– Metasoma slightly longer or shorter than mesosoma; ovipositor, if exserted, the exserted part of ovipositor not more than 1/5 of metasoma **10**

10 F1–F5 transverse or at least broader than long (Fig. 4A)..... **11**

– F1–F5 longer than broad or quadrate (Fig. 2A)..... **12**

11 Clava as long as F2–F6 combined; hind femur yellow at apex (Fig. 4F) ..... ***P. colposceniae* Trjapitzin**

– Clava as long as F3–F6 combined; hind femur dark brown, basal 1/3 of hind tibia dark brown..... ***P. taiwanus* Xu**

12 Ovipositor obviously exserted; the exserted part of ovipositor ~ 1/4 of metasoma; F6 quadrate (Fig. 2A); mid coxa yellow, but apical or so 1/3 dark brown (Fig. 2F) ..... ***P. caillardiae* Sugonjaev**

– Ovipositor slightly exserted, the exserted part of ovipositor no more than 1/5 of metasoma; F6 ~ 1.1× as long as wide; mid coxa entirely dark brown ... **13**

13 All funicular segments longer than broad; hind femur yellow (Fig. 5F) ..... ***P. densiciliatus* Tan & Zhao**

– At least one segment of funicle not longer than broad; hind femur broadly dark brown (Figs 1G, 6F)..... **14**

14 F1–F5 longer than broad, F6 quadrate (Fig. 1A); OL ~ 4.5× as long as GL (Fig. 1H) ..... ***P. arenarius* Trjapitzin**

– F1 and F5 quadrate, F2–F4 longer than broad, F6 broder than long (Fig. 6A); OL ~ 5.5× as long as GL (Fig. 6G) ..... ***P. elaeagni* Trjapitzin**

Acknowledgements

We are grateful to Professor Yaogeng Tan (Hubei University) for providing photos of holotype of *Psyllaephagus densiciliatus* and Dr George Japoshvili (Agricultural University of Georgia) for help of citations. We thank Dr. JS Noyes (Natural History Museum, London) and an anonymous reviewer for their comments and valuable advice about the MS.

Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

Funding

This project was supported by National Natural Science Foundation of China (NSFC Grant No. 32170431) and the National Key R & D Program of China (Grant No. 2021YFD1400200).

Author contributions

Conceptualization: YZ, BZ, HH. Data curation: BZ. Formal analysis: YZ, HH. Investigation: LZ. Methodology: LZ. Project administration: YZ. Resources: HH, YZ. Writing - original draft: BZ. Writing - review and editing: BZ.

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Data availability

All of the data that support the findings of this study are available in the main text.

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